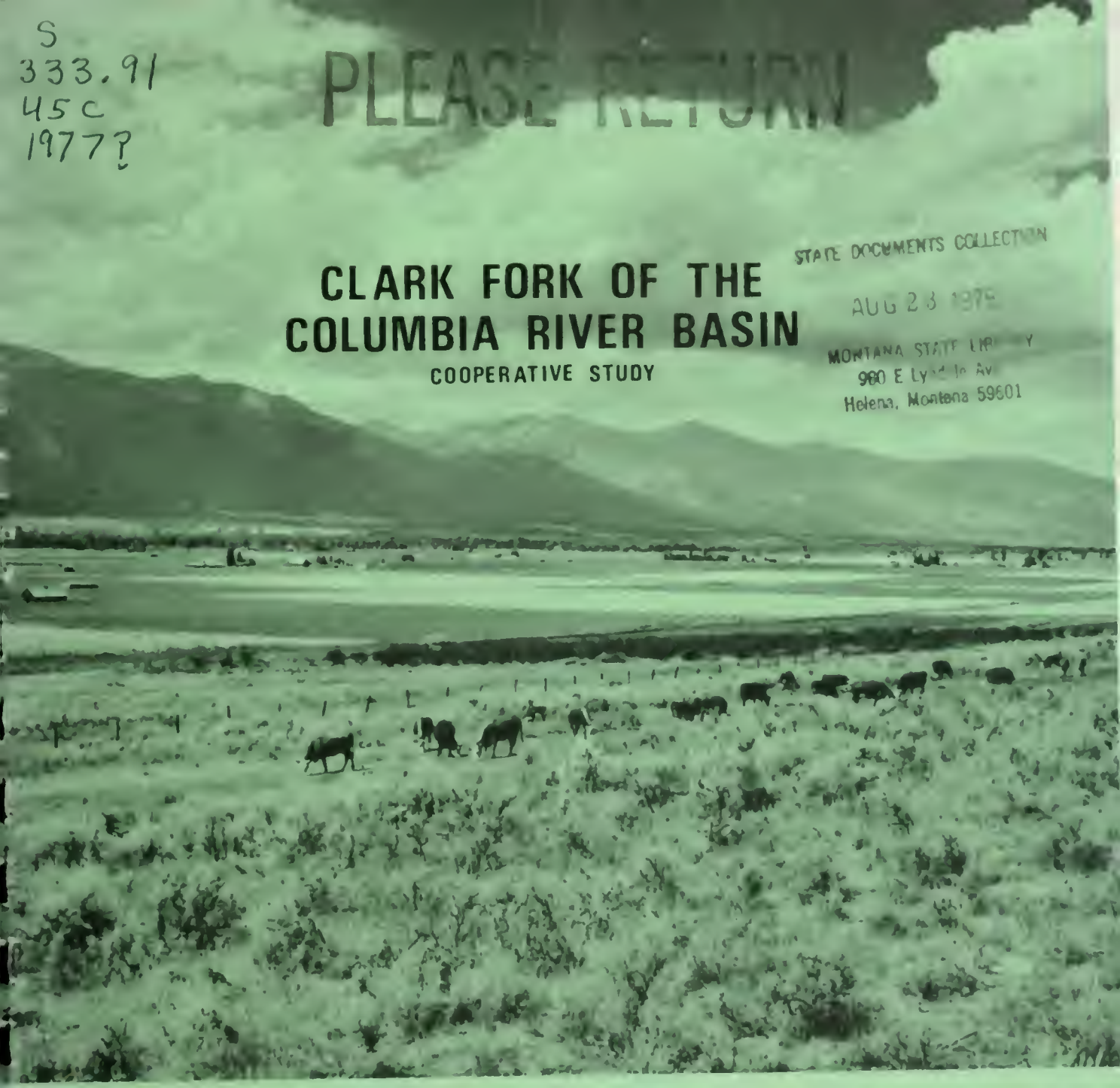
CLARK FORK OF THE COLUMBIA RIVER BASIN

COOPERATIVE STUDY



PREPARED BY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ECONOMIC RESEARCH SERVICE
FOREST SERVICE

IN COOPERATION WITH

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

USDA SCS PORTLAND OR 1977

CLARK FORK OF THE COLUMBIA RIVER BASIN
USDA COOPERATIVE STUDY

TABLE OF CONTENTS

MAP NO.	TITLE
II-1	Project Map
II-2	General Topography
III-1	Economic & Hydrologic Study Areas
III-2	Wetland and Drainage Inventory
III-3	Generalized Sediment Yield
IV-1	Elk Winter Range
IV-2	Deer Winter Range
IV-3	Moose, Sheep & Goat Range
IV-4	Bear Range
IV-5	Ruffed Grouse
IV-6	Blue Grouse
IV-7	Pheasant
IV-8	Hungarian Partridge
IV-9	Turkey
IV-10	Fisheries
V-1	Average Frostfree Season
V-2	Average Annual Precipitation
V-3	Average Annual Water Yield
V-4	Generalized Geology
V-5	General Mineral Resources
V-6	Generalized Soil Map
V-7	General Vegetation Types
V-8	Land Ownership
V-9	General Land Use
V-10	Rangeland by Condition
V-11	Commercial and Noncommercial Forests
V-12	Irrigated and Dry Cropland & Irrigable Lands
V-13	Average Annual Stream Flows
V-14	Ground Water Available for Irrigation
V-15	Recreation Facilities
X-1	Watershed Investigation Analyses

I--SUMMARY AND CONCLUSIONS

HOW AND WHY THE STUDY WAS INITIATED

The Montana Department of Natural Resources and Conservation (MDNR&C) requested the U. S. Department of Agriculture to assist in conducting a cooperative study in this basin. The Department of Agriculture agreed to conduct this study under provisions of Section 6 of Public Law 566, as amended. Findings of the study are needed by the MDNR&C to help plan for the optimum use and development of the water and related land resources of the basin as part of the Montana State Water Plan. USDA agencies need the findings to identify water and related land resource problems, potential projects, ongoing programs that need acceleration, potentials for new programs, and assessment of capabilities and limitations of natural resources of the basin to meet the type, quantity, and quality of desired beneficial effects. Primary objectives of the study are to provide plans for use, development, management, and conservation of water and related land resources of the basin in a manner that will provide a balance between national economic development and environmental quality goals.

SIZE AND LOCATION OF THE BASIN

This basin includes all of Powell, Granite, Ravalli, Missoula, Mineral, Lake, and Sanders Counties, most of Flathead County, about half of Deer Lodge and Silver Bow Counties, and small parts of Lewis and Clark and Lincoln Counties. All the Flathead Indian Reservation and over half of Glacier National Park are in the basin. The basin is primarily mountainous and most of the basin is forested. There is an abundance of lakes and streams. The basin is about 240 miles long from north to south and about 170 miles wide from east to west and contains about 21,602 square miles or 13,825,170 acres of land and water.

PROBLEMS AND OBJECTIVES

Problems were identified from framework studies, public involvement meetings, resource reports, and many varied publications. These problems were divided into economic development emphasis and environmental quality emphasis categories. Through discussion processes, it was decided what desirable action should be taken to solve or alleviate each problem and these were expressed as objective components. The following table shows the problems and their related objective components.

Economic Development Problems	Objective Components
*(1) Declining natural resource base and a related decline in basic extractive employment in agriculture, forest industries, and mining and smelting.	(1) Maintain production from renewable natural resources and attract other basic industries needed to replace declining basic employment.
(2) Floods periodically damage residences, transportation facilities, businesses, and agricultural lands.	(2) Reduce flood damage impacts in the basin.
(3) About 97,000 acres of cropland with high water tables are not now producing up to their cropping potentials.	(3) Control water table problems.
(4) About 208,000 acres now irrigated are short of late-season water.	(4) Provide full-season water supply to irrigated lands.
(5) Twenty-four communities have problems with municipal water storage or distribution facilities.	(5) Provide adequate municipal water supply systems.
(6) Imbalanced recreation services and facilities on public lands.	(6) Adjust supply, kind, and quality of recreational services and facilities to satisfy preferences.
(7) Insufficient supply of recreational facilities in and near urban areas.	(7) Provide additional urban recreational facilities to satisfy demands.
(8) Low income of many private outdoor recreation enterprises.	(8) Provide better economic advice to recreation enterprise owners and potential developers.
(9) Insufficient access points on streams and public lands forces overuse at existing access sites.	(9) Provide more access points to streams and public lands.
(10) Difficult boating access on 11 reservoirs with fluctuating water levels and on 5 white-water river sites.	(10) Improve access for boating.

*A parenthesized number is provided for each problem and appears throughout the report to assist the reader.

(11) Improper land, irrigation, and timber management holds agricultural and timber production below its potential.	(11) Improve land, water, and timber management to bring agriculture and timber production up to its feasible potential.
(12) About 84,000 acres of "other" lands now have excessive erosion.	(12) Reduce erosion on 84,000 acres of "other" lands.
(13) The basin is a net importer of electrical power and the demand is increasing.	(13) Provide adequate power as needed.
(14) Productive agricultural and commercial forest land is being lost to subdivision, thereby reducing the natural resource base.	(14) Stop subdivision of the better agricultural and commercial forest land.
Environmental Quality Problems	Objective Components
(15) Erosion and sediment from agricultural, forest, and "other" lands cause reduction in environmental quality.	(15) Reduce sediment from agricultural, forest, and other lands.
(16) High sediment production, particularly from erosive streambanks, in the Little Bitterroot and Upper Blackfoot.	(16) Reduce streambank erosion.
(17) Municipal and industrial wastes are polluting streams and lakes.	(17) Upgrade sewage and waste disposal to stop pollution.
(18) Nonpoint water pollution is being caused by runoff from agricultural, forest, and rural residential areas.	(18) Reduce chemical, thermal, and nutrient pollution from rural areas.
(19) Fluctuating water levels on 11 reservoirs expose barren areas and mudflats and reduce natural beauty.	(19) Reduce water fluctuations of reservoirs.
(20) Agricultural, residential, and road encroachment on riparian lands reduces natural beauty.	(20) Protect riparian vegetation.
(21) Insufficient access points to public lands causes concentrated use which destroys natural beauty.	(21) Provide more access points and disperse recreational use.

(22) Clearcutting in large blocks, overgrazing, and erosion destroy natural beauty.	(22) Protect open and green space with better planning and land management.
(23) Reservoirs have impounded segments of previously free-flowing streams.	(23) Preserve all remaining free-flowing streams.
(24) Fish and aquatic habitat are damaged by late-season dewatering of streams by irrigation diversion.	(24) Maintain minimum streamflows needed for fishery and aquatic habitat.
(25) Fluctuating streamflows and temperatures caused by generating releases from Hungry Horse Reservoir damage fishery and food organisms in Flathead River.	(25) Provide control of fluctuating flows and temperatures from Hungry Horse.
(26) Wildlife habitat is being lost to agricultural, residential, industrial, and transportation encroachment on riparian, forest fringe, and wetland areas.	(26) Preserve adequate waterfowl, big game, upland, and other wildlife habitat.
(27) Upstream migration of salmon and trout is hindered by structures such as Big Fork Dam, poorly installed culverts, bridges, and irrigation diversions.	(27) Provide adequate fish migration passage around manmade structures.
(28) Subdivisions are encroaching on wildlife habitat in riparian and forest fringe areas.	(28) Stop subdivision of wildlife habitat.

NEEDS

The recommended early action plan has a target date of 1990. The formulation of accomplishment goals for this plan is based on an analysis of the components of the objectives. Some of these components are related to the projected demand in 1990 and they increase in magnitude over time. Provisions of ongoing programs, where they exist, were estimated and used to adjust the magnitude of the early action plan goals in 1990. Some components are not related to the projections in demand and are treated as backlogs that do not necessarily increase in magnitude over time. Once treated, these backlogs are assumed to disappear and the associated problems are solved. Provisions of ongoing programs in removing such backlogs

are also estimated and used to adjust the size of the remaining backlogs in 1990. In both cases the resulting adjusted magnitudes of the component of the objectives in 1990 are developed as the NEEDS to be accomplished in the preferred plan.

The early action remaining needs are summarized below.

Economic Development

(1) Need 7,350 more basic jobs by 1990 to provide for increased population and to offset decline in agricultural, forest products, mining, and smelting jobs.

(2) Financial impacts of residential flooding will have been reduced by ongoing programs, although occasional flooding will continue on 64,000 acres of agricultural, urban, and other lands.

(3) Improve production on 90,000 acres of cropland that are classes as types I and II wetland.

(4) Full season supply of water for 197,500 acres of irrigated land now short 324,800 acre-feet of late-season water.

(5) Improve water systems for 20 communities.

(6) Increase of 184 more camp units at critical areas on public land and an increase of 190% in management services on recreational forest land.

(7) Present rate of recreation facility development by ongoing programs will supply projected needs by 1990.

(8) Most low-income commercial recreational facilities will have been phased out by 1990 and investors will be better informed.

(9) Need 40 more fishing sites and 19 more access sites across private land onto national forest land.

(10) Need six more long boat ramps with floating docks on fluctuating reservoirs and five boat ramps on rivers.

(11) Increase production on 109,100 acres of currently irrigated land and 1,560,000 acres of commercial forest land.

(12) Protect 56,000 acres of "other" land.

(13) The requirement for an additional 9,180 million kilowatt hours of electricity by 1990 will be met by ongoing programs.

(14) Maintain current use of 47,000 acres of high-quality agricultural and forested land now projected for subdivision.

Environmental Quality

(15)(16) Reduce erosion and sediment from 110,500 acres of cropland; 56,000 acres of "other" land; 61,000 acres of forest land; and from 2,460 miles of roads and trails and 51 miles of streambanks.

(17) Increase in services to completely control water pollution from 21 communities.

(18) Accelerate irrigation water management and conversion to sprinkler irrigation on 109,130 acres to reduce diversion requirements and irrigation return flows.

(19) Reduce water fluctuations on 11 reservoirs during summer.

(20) Protect 79,000 acres of riparian vegetation.

(21) Need 19 more access sites to national forest land.

(22) New legislation to protect open and green space.

(23) Keep 2,297 miles of free-flowing streams.

(24) Reserve minimum streamflows on 2,484 miles of class 1 through 4 live streams.

(25) Regulate temperature and flow fluctuations below Hungry Horse dam.

(26) Manage 1,300,000 acres of big game range; 13,600 acres of upland; and 122,800 acres of wetland habitat for wildlife.

(27) Provide fish passage around all blockage structures.

(28) Protect 47,000 acres of wildlife habitat that will otherwise be subdivided by 1990.

FINDINGS AND CONCLUSIONS

The Economic Scene

Personal per capita income is lower for the people in the basin than the national average. Unemployment is slightly higher than the national average. Much of the basin's income depends on forestry and mining. Under the present situation, both timber supplies and metal ores are being depleted and are becoming more expensive to produce. Some positive action will be required if this area is to maintain or improve the high standard of living for the existing or an expanding population. Forestry and mining account for

60 percent of the total basin basic income while agriculture and related industry accounts for 12 percent. About two percent of the basin's basic income comes from nonresidents participating in outdoor recreation and related activities (tourism). Over 21.1 percent of all persons employed in the basin in 1970 were employed by either federal, state, or local government. State and federal employment brings in outside money and is considered as basic employment while local government consumes local taxes and is considered as derivitive employment. Basic government employment (state and federal) is about 12.9 percent of total employment, while derivitive (local) government employment is about 8.2 percent of total employment.

If the basin's population is to continue to increase at its present rate, which approximates OBERS level C population growth, it will need an increase of basic employment of 5,400 jobs by 1990 in order to support related derivitive employment and projected populations at present standards of living. The two most likely alternatives to that increase in basic employment are lowered standards of living for the larger population or a stagnation and decline in basin population. During the time that there is a need to increase basic employment, there is a persistent decline in agricultural, forest products, mining and smelting sectors of basic employment.

The Mineral Industry Scene

The copper industry strongly dominates the economic scene of the Upper Clark Fork subbasin and whatever happens to copper affects most of the lives and employment of that area. Although the volume of production remains fairly constant, employment in this sector persistently declines. As with all stock (nonrenewable) resources, the highest quality and least costly to extract ores are being depleted. Lower percentage ores provide less gross revenue per ton mined and less profit for the copper company to work with.

The Forestry Scene

The supply of sawtimber is decreasing because of harvest, disease, insects, and classification into reserved status and will continue to decrease under existing levels of management.

Present economic conditions do not generally encourage more intensive management on much of the private forest land. The demand for timber is expected to increase. The demand for reserved forest areas is also expected to increase. A large number of private forest landowners have not harvested available timber in order to maintain scenic values. There is potential to produce more timber than at present and at a reasonable cost if more intensive management is applied on the more productive forest lands which need management now and in the future. However, because of the long growth cycle, most of the benefits of this more intensive management would not accrue until after 2020.

A serious limiting factor for improved management is the lack of roads for preharvest management. Funds are not now available to construct these roads on federal land or to provide the needed management. Delays now are expected to result in higher costs of management in the future.

The Agricultural Scene

About 16 percent of the basin area is used for agriculture. Range and dry pastureland account for about 12 percent of the basin's land use. Some of the public land and a small part of the national forest are used for grazing.

Less than 5.4 percent of the basin is in cropland. Three percent is in irrigated crops and pasture and about two percent is in nonirrigated crops. Flathead, Mineral, and Sanders Counties have increased irrigated areas in the last 30 years. Total irrigated areas have not significantly changed in the other counties, although some land has been withdrawn from irrigation and new irrigated land has been developed. Cultivated irrigated crop areas have decreased in Missoula, Ravalli, and Lake Counties. Total agricultural production has either been maintained or increased in all counties except Missoula. Crop yields and alternative crops are limited by the cool climate and small uneconomical part-time farms. A lesser factor is irrigation water shortages in late summer. However, some improvements in production will continue to increase with improved varieties, fertilizer application, and improved management. Fish aquaculture has seen a dramatic increase in recent years, although it involves very few landowners. Employment in the agricultural sector is expected to continue its slow decline.

The Outdoor Recreation and Tourism Scene

This basin is an attractive area for recreation. A large number of residents and nonresidents participate in outdoor recreation in the basin during the year. However, many private outdoor recreation developments are in financial trouble and many developed facilities on public land are not completely used during the outdoor recreation season. Local residents and others frequently prefer areas with solitude and without developed facilities. Both motorized and nonmotorized use of trails is increasing.

There is a need for more recreational management and informational services on public land. Additional campsites and picnic tables are needed along the interstate highway and at critically overused sites on public lands.

Some kind of regulation of dispersed types of recreation may be needed if more problems develop in the future.

The Environmental Scene

This basin generally has a high-quality environment. Some localized pollution occurs. The principal air pollution problems are from industries near Butte, Anaconda, Missoula, and Columbia Falls.

The principal water quality problems are organic pollution in the Ashley Creek Watershed near Kalispell and salts and heavy metals ions in the main stem of the Clark Fork River from Butte downstream. There is some problem with sediment in some streams in the Blackfoot River, Little Bitterroot, and other areas. A number of towns and communities need improved sewage treatment facilities.

The more serious erosion occurs along streams as bank erosion. Some small projects are constructed each year to control such erosion.

On a total basin basis, irrigation probably diverts less than nine percent and consumes less than three percent of the surface water flow. However, irrigation diversions reduce streamflows below minimum flows for desirable fisheries on a number of tributary streams.

Subdivision and other human activities are encroaching on winter ranges critical for big game animals and on riparian and wetland habitat that is critical to other wildlife.

A number of historical and archeological sites exist in the basin, but restoration and preservation efforts are not common.

PLAN ELEMENTS RETAINED IN THE PREFERRED EARLY ACTION PLAN

ECONOMIC DEVELOPMENT ELEMENTS

(1) Provide more manufacturing for export and more services to people from outside the basin in order to create about 6,152 more basic employment jobs that will be needed to support the population projected for 1990.

(3) Drain about 12,800 acres of cropland that are classed as types I and II wetlands that are not contiguous to types III and IV wetlands. The remaining 77,200 acres of I and II wetlands will be reserved for wildlife habitat.

(4) Store about 28,000 acre-feet of excess spring runoff for late-season use. About 19,730 of these acre-feet will provide a full irrigation supply for 11,560 acres.

(5) Improve municipal water systems for 20 towns.

(6) Increase recreational services maintenance for public lands by $1,135,000 per year and construct 184 camper stalls at critically overused sites on the national forests.

(9) Acquire 40 more stream fishing access sites and acquire and develop 19 more general recreational use access sites to national forest lands and establish legal rights-of-way on all existing accesses.

(10) Provide a boat ramp and a floating dock on each of six reservoirs and boat ramps at five white-water river sites.

(11) Accelerate land treatment to increase production on 109,130 currently irrigated acres and 1,150,000 acres of commercial forest.

(12) Accelerate land treatment to stop erosion damage on 56,000 "other" land acres.

(14) Stop subdivision of better agricultural and commercial forest lands.

ENVIRONMENTAL QUALITY ELEMENTS

(15)(16) Accelerate land treatment to prevent erosion and sediment production on 110,500 acres of dry cropland; 56,000 acres of other lands; 61,000 acres of forest land; 51 miles of streambanks; and 2,460 miles of roads and trails.

(17) Provide accelerated assistance to provide tertiary sewage treatment for 21 towns to stop point-source water pollution.

(18) Accelerate conversion to sprinkler irrigation and improve other irrigation management practices on 109,130 acres of irrigated land to reduce nonpoint irrigation return flows and reduce amounts of water diverted from streams.

(19) Operate reservoirs, within practical limits, to minimize summer exposure of mudflats.

(20) Protect 79,000 acres of riparian vegetation.

(21) Provide 19 additional developed access sites to public land and secure legal rights-of-way for existing accesses to help disperse recreational use.

(22) Preserve and protect open and green space and natural beauty.

(23) Preserve 1,123 miles of fishery classes 1, 2, and 3 streams in their free-flowing state.

(24) Reserve minimum streamflows, not already subject to diversion, for 2,484 miles of live streams.

(25) Build a reregulating dam below Hungry Horse Reservoir.

(26) Manage critical wildlife habitat for wildlife on 183,000 acres of big game winter range, 9,700 acres of upland habitat, and 105,200 acres of wetlands.

(27) Improve fish passage around manmade obstructions.

(28) Stop subdivision of riparian and forest-fringe wildlife habitat.

OPPORTUNITIES FOR USDA PROGRAMS

Nine of the 13 NED plan elements retained in the preferred plan can be largely accomplished under accelerated USDA programs and the other four elements can be assisted with technical advice under USDA programs. Ten of the 16 EQ plan elements retained in the preferred plan can be met in part or in whole by USDA programs, and USDA agencies can provide technical advice on the other six elements. Table IX-1 presents the plan elements of the preferred plan and their relationship to plan items shown in parentheses throughout this report. The table shows the related increases in annual commodity production and the beneficial and adverse effects under National Economic Development, Environmental Quality, Regional Development, and Social Well Being Accounts and the agencies and programs that would be involved in plan element implementation.

RECOMMENDATIONS FOR FURTHER STUDY

The Montana Department of Natural Resources and Conservation (MDNR&C), through its land classification program, has identified 1,200,000 acres of physically irrigable land in the Clark Fork basin. The State has a policy of assistance to agricultural development and wants to know which of these physically irrigable lands are feasible to irrigate. Some of these acres were evaluated under watershed investigations, but other areas were not evaluated because they were too large for PL-566 consideration or they consisted of small areas that would be restricted to private farm developments. It is recommended that these identified potentials be evaluated under a USDA-cooperative special study similar to one now under way in the Upper Missouri subbasin in Montana.

II. INTRODUCTION

This report presents the findings of the USDA Cooperative River Basin study of the Clark Fork of the Columbia River in Montana. The study area includes all of Montana west of the continental divide except the drainage of the Kootenai River and its tributaries. See map II-1.

HOW AND WHY THE STUDY WAS INITIATED

The Montana Department of Natural Resources and Conservation (MDNR&C) requested the U. S. Department of Agriculture to assist in conducting a cooperative study for this basin. The Department of Agriculture agreed to conduct this study under provisions of Section 6 of Public Law 566, as amended. Findings of the study will be used by the MDNR&C to help plan for the optimum use and development of the water and related land resources of the basin as part of the Montana State Water Plan. USDA agencies will use the findings to identify water and related land resource problems, potential projects, ongoing programs that need acceleration, potentials for new programs, and assessment of capabilities and limitations of natural resources of the basin to meet the type, quantity, and quality of desired beneficial effects.

OBJECTIVES AND NATURE OF THE STUDY

Primary objectives of the study are to provide plans for use, development, management, and conservation of water and related land resources of the basin in a manner that will provide a balance between national economic development and environmental quality goals. Data are presented on land use, vegetation, grazing resources, wildlife habitat, outdoor recreation, conservation district programs, land treatment measures, potential small project measures, municipal and rural water and sewer development, forestry management and land treatment needs on federal and nonfederal forested lands, and potential rural electrification projects. Local organizations can sponsor the development of most of these potential projects under provisions of various land and water programs. The study provides valuable information to aid the orderly development of the region and enhancement of the quality of life for residents of the basin.

DESCRIPTION OF THE STUDY AREA

This basin includes all of Powell, Granite, Ravalli, Missoula, Mineral, Lake, and Sanders Counties, most of Flathead County, about half of Deer Lodge

and Silver Bow Counties, and small parts of Lewis and Clark and Lincoln Counties. All the Flathead Indian Reservation and over half of Glacier National Park are in the basin. The basin is primarily mountainous and most of the basin is forested. There is an abundance of lakes and streams. Population density is 9.5 persons per square mile with 28.6 persons per square mile of private land or 22 acres of private land per person as compared with 57 persons per square mile total land nationally. Another measure of this "elbow room" is that there are 12.9 acres of wilderness, national park, or wilderness study areas for each occupant in the basin. Much of the scenery is spectacular, wild, and challenging.

The basin is about 240 miles long from north to south and about 170 miles wide from east to west and contains about 21,602 square miles or 13,825,170 acres of land and water.

Elevations vary from about 2,175 feet above mean sea level at Cabinet Gorge Reservoir at the Montana-Idaho state line to about 10,665 feet on the higher peaks in the Pintlar Wilderness. See map II-2. Precipitation varies from over 100 inches annually on a few high peaks to about 10 inches in the upper part of the Deer Lodge Valley. Water yields range from about 100 inches annually in some small mountain areas to less than 4.5 inches in semiarid valley areas. The average annual streamflow of the Clark Fork where it leaves the basin is about 16,220,000 acre-feet. There are no significant diversions into or out of the basin, but there is an average annual inflow of about 718,700 acre-feet from Canada in the North Fork of the Flathead River.

The Burlington Northern Railroad serves most of the basin area. The Chicago, Milwaukee, St. Paul and Pacific Railroad serves the southern part of the basin along the Clark Fork River. A branch of the Union Pacific Railroad serves Butte from the south. The Butte, Anaconda, and Pacific Railroad serves as the principal ore hauling road between Butte and Anaconda.

The basin is served by interstate highways 90 and 15 with considerable construction to be completed. Federal highways 2, 10, 10A and 12 cross the basin from east to west and U. S. 93 crosses from north to south. The main state primary highways include numbers 200, 28, 35, and 209. A good network of secondary highways and county roads serves the inhabited area.

Institutions of higher education in the basin include the University of Montana at Missoula, Montana College of Mineral Science and Technology at Butte; and Flathead Valley Community College at Kalispell. Nearly every town has a high school and many of the larger towns have hospitals. The state prison at Deer Lodge, the state mental hospital at Warm Springs, and the state hospital for respiratory diseases at Galen are located in the Deer Lodge valley.

MAP III

PROJECT MAP

CLARK FORK OF THE COLUMBIA RIVER BASIN

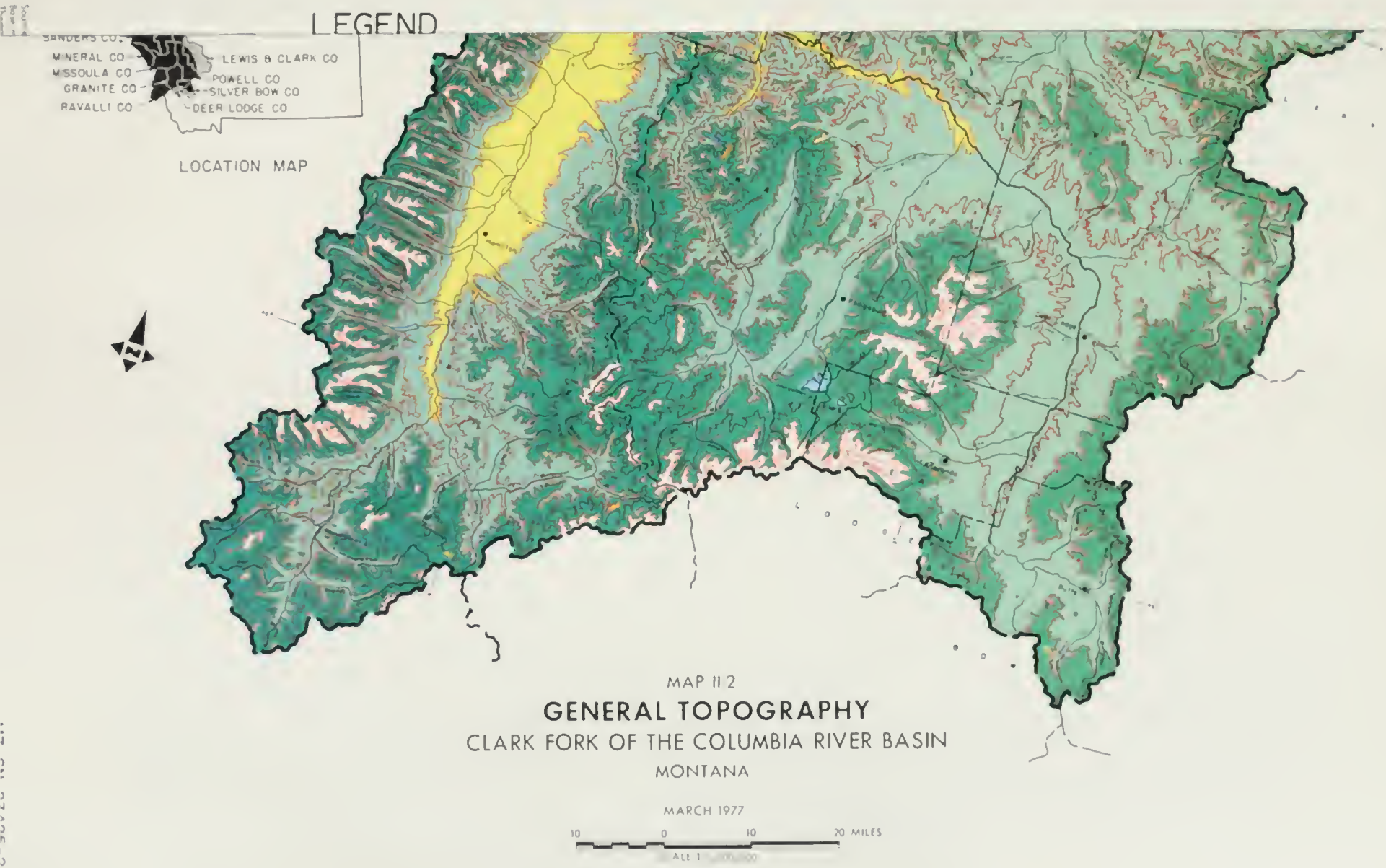
MONTANA

MARCH 1977

10 0 10 20 30 40 MILES

SCALE 1:1,000,000

Source:
Base map prepared by SCS, Portland Cartographic Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.


LEGEND
SANDERS CO.
MINERAL CO
MISSOULA CO
GRANITE CO
RAVALLI CO
LEWIS & CLARK CO
POWELL CO
SILVER BOW CO
DEER LODGE CO
LOCATION MAP
MAP II 2
GENERAL TOPOGRAPHY
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10 0 10 20 MILES

Source:
Base map prepared by SCS, Portland Cartog. Unit from AMS 1:250,000 series.
Thematic detail prepared by Steve Swift.
U.S. DEPARTMENT OF AGRICULTURE

MAP II-2

GENERAL TOPOGRAPHY

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

SCALE 1:1,000,000

M7-SN-23425-24

The economy of the basin is based on forest products, mining and metal reduction, agriculture, governmental and university activities, light industries, and tourism. About half the work force in the basin is employed in these basic industries. The other half of the work force is employed in associated support services and industries, including local outdoor recreation services. (Basic economic sector as used here includes those activities which produce goods or services that bring outside money into the basin.)

The forest products industry provided over 171 million dollars to the economy in 1969 while employing over 7,000 persons with an annual payroll of more than 47 million dollars. Value-wise, copper is the most important metal produced in the area, followed by zinc, lead, silver, and gold. Nonmetallic minerals include phosphorus, fluorite, and quartz. Mining and concentration of ore are centered at Butte, while smelting and refining are completed at Anaconda. Alumina from outside the basin is reduced to aluminum at Columbia Falls. Phosphate rock is converted to agricultural chemicals and other products at Rocker near Butte. Agricultural production in the basin in 1969 included $38,376,000 in livestock and livestock products and $9,374,000 in cash crop sales for a total of $47,750,000. Based on cost-return studies, these sales would provide about $15,000,000 in operators' disposable income. Governments employ about 21 percent of the labor force. About 3.9 percent of the labor force work in lodging and personal services, part of which is for tourism and recreation. 1/

AGENCY RESPONSIBILITIES

During the study, the participating agencies were assigned specific responsibilities. Following is a list of the agencies and their responsibilities:

SOIL CONSERVATION SERVICE (SCS)

The Soil Conservation Service had responsibilities for:

-- Providing the chairman of the Field Advisory Committee, which provided guidance for the study.

-- Assisting in an appraisal of water yield and consumptive use on present and potential developments.

-- Making a physical appraisal of soils, land suitability, crops, and fish and wildlife resources for present and future uses.

-- Determining the extent of floodwater, sediment deposition and erosion damage, including evaluation of floodwater damages and drainage benefits, and evaluating benefits from multiple purpose water developments.

1/ U. S. Department of Commerce, Bureau of the Census.

-- Making physical appraisals, field investigations, and feasibility estimates for possible small watershed projects or Resource Conservation and Development project measures, while determining their relationship to existing and potential resource developments.

-- Determining land treatment and water management necessary to control erosion, prevent pollution, and provide for proper use of nonforested nonfederal lands.

-- Cooperating and consulting with other agencies on land and watershed management programs.

-- Appraising present recreational opportunities on all nonfederal lands.

-- Assembling, reviewing, and evaluating data gathered, assisting in plan formulation and in the drafting of supplementary material for consideration of the Field Advisory Committee.

-- Preparing the cooperative river basin survey report with assistance from the other agencies.

-- Contributing to the economic base study and in its interpretation and application in the study.

ECONOMIC RESEARCH SERVICE (ERS)

The Economic Research Service had the responsibility for the economic aspects and elements of basin planning. ERS, in cooperation with the other USDA agencies and the State of Montana, compiled economic data and made economic analyses, at varying levels of intensity, relating to the agricultural sector and its use of land and water resources. This included the following:

-- Describing the economics of the area and the trends in its future development, stressing the economic effects of water and related land resource uses in the area. Preparing and completing a report on the economic base analysis and preliminary projections for use early in the study.

-- Analyzing and projecting economic activity in the agricultural and related sectors with consideration of demand for agricultural goods and the interaction of demand and supply of resources.

-- Analyzing the economic impacts of resource-related problems.

-- Analyzing economic and institutional factors involved in the formulation of a coordinated plan and an analysis of alternative courses of action for water and related land resource use and management.

-- Adapting available projections of the demand for and value of significant types of water-oriented outdoor recreation opportunities in the region to various areas in the basin.

-- Assembling, reviewing, and evaluating data gathered, assisting in plan formulation and consideration of relevant alternatives, and drafting reports and supplementary material for consideration of the Field Advisory Committee.

FOREST SERVICE (FS)

The Forest Service had the responsibility for:

-- Analyzing the forest resource sector of the economy and contributing to the economic base study prepared by ERS.

-- Identifying the nature and quantity of measures required on national, state, and private forest lands for watershed protection, flood prevention, recreation, water yield improvement, and timber production.

-- Cooperating with other agencies in estimating the impact of recreational development or activities on national, state, and private forest lands and other federally administered lands. The interdependency of recreation activities on lands of various ownerships and locations was also studied.

-- Cooperating with the MDNR&C Division of Forestry and the Conservation Districts in determining the needs for measures on state and privately owned forest lands.

-- Determining present use and probable future needs for water on national, state, and private forest lands for administrative uses, industrial and other commercial uses, livestock and agriculture, recreational uses, and other uses, and appraising water needs of forest-based industries.

-- Cooperating with the MDNR&C Division of Forestry and other agencies in reviewing and evaluating available published and unpublished data concerning soil and water resources of forested lands and in collecting additional basic physical data needed for the study.

-- Collaborating with the SCS and the State in defining the watershed study areas and evaluating their characteristics, water yields, and contributions to floodwater and sedimentation problems.

-- Collaborating with other land management agencies to determine present and future cover conditions and treatment needs for all forest and mountainous wild lands.

-- Appraising prospective economic impacts of formulated development plans and alternatives.

-- Assisting in interpretation of data, plan formulation, and in the drafting of a report and supplementary material for consideration of the Field Advisory Committee.

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

The Water Resources Division of the Montana Department of Natural Resources and Conservation assumed responsibility for the following aspects of the survey:

-- Arranging for cooperation as needed with non-USDA federal agencies, state, and non-agriculturally oriented local agencies and provided for liaison with these agencies.

-- Compiling and analyzing irrigated and irrigable land data and stream runoff information.

-- Compiling information relating to water rights and the present use of water.

-- Recommending opportunities for potential use of water and related land resources.

-- Preparing summaries showing present status of water resource development and potential development.

-- Coordinating the efforts of other state agencies providing data for the survey, including the Departments of Fish and Game, Health and Environmental Sciences, Agriculture, Lands; Bureau of Mines and Geology; Community Affairs; and the Conservation Districts Division and Forestry Division of MDNR&C.

-- Determining the need for additional streamflow and precipitation information and making arrangements for its collection.

-- Making arrangements with the Cooperative Extension Service for assistance on education and information matters.

-- Assisting in interpretation of data, plan formulation, and in the drafting of a report and supplementary material for consideration of the Field Advisory Committee.

-- Coordinating public involvement for the study.

ACKNOWLEDGEMENT OF DATA AND ASSISTANCE FROM OTHERS

Local entities, including conservation districts, irrigation and drainage districts, city-county planning boards, regional planning associations, other local authorities, newspapers, civic groups, and individuals provided:

-- The continual identification of problems, needs, and opportunities related to land and water resource use and development.

-- Supplementary inventory inputs, as available, pertaining to yields by soil classification, soil and water management needs, farm plan development, local economic considerations, group facility developments, small livestock and irrigation water developments, present and proposed recreational use and developments.

Data and information available from other federal agencies were used to the fullest extent possible. Land classification surveys, economic data and hydrologic studies and project plans of the Bureau of Reclamation, Corps of Engineers, Bureau of Land Management, and the Bureau of Indian Affairs were reviewed and appropriate use and coordination made with information obtained from other sources. Reports of the Environmental Protection Agency were reviewed and studied with regard to their relationship to the survey area and the use and development of its water and related land resources. Climatological records of the Weather Bureau were used, as were hydrological records and studies of the Geological Survey.

Recreation information prepared by the Bureau of Outdoor Recreation and by the Recreation Data Subcommittee of the Pacific Northwest River Basins Commission was used in the study. Information obtained on private recreation facilities by and for the Conservation Districts was also used in the study.

The Montana Department of Fish and Game, the National Park Service, and Fish & Wildlife Service provided data on fish and wildlife needs and problems. Land use and management needs and plans of the Bureau of Land Management and the Bureau of Indian Affairs were coordinated with field observations and information from other sources. Assistance was obtained from the Farmers Home Administration and Montana Department of Health and Environmental Sciences to establish the need for rural community water supply and sewage improvements. The Rural Electrification Administration and REA cooperatives were consulted in relation to development needs in rural areas. Agricultural statistics were provided by the Statistical Reporting Service and Agricultural Stabilization and Conservation Service.

Numerous other organizations, both private and public, contributed to the study and their assistance is appreciated.

III. PROBLEMS AND OBJECTIVES

INTRODUCTION

This chapter presents the public concerns which precipitated the study, delineates the problems identified during the study, and enumerates the desired objectives for economic development and environmental quality for future timeframes.

During the development of the plan of work for this study, maximum use was made of existing information to identify problems and potentials for resource management and development. Data were used from the Columbia-North Pacific Comprehensive Framework study, Resource Conservation and Development project plans, historical flood records, local planning agency reports, state and federal agency reports, and many private sources. Early in the study, public involvement meetings were held at nine different locations in the basin to explain the scope of the study and to elicit public input in identifying problems, potentials, and desires related to water and associated land resources. Information data from these sources are presented in this report for three economic or hydrologic subareas: Upper Clark Fork, Lower Clark Fork, and Flathead as shown in map III-1.

The overall goal of this planning activity is to provide guidance and alternatives in the wise use of water and land resources to improve the quality of life in the basin through achieving a balance between economic development and environmental quality objectives.

The two major objectives are national economic development (NED) and environmental quality (EQ). The NED objective is achieved by increasing the value of goods or services. This can be done by increasing the output of food, fiber, and recreation or other services or by more efficient use of the resources. Additional NED effects occur as secondary or external economies. For example, increased food or timber production may improve the economy of the transportation industry and provide increased employment opportunities. The EQ objective calls for conservation, preservation, creation, restoration, and improved management of natural, cultural, and ecological resources.

PROBLEMS

The following problems are categorized as to their major effects on economic or environmental objectives. The problems are somewhat different for the three economic subareas shown on map III-1. Also, the rate of change of the natural resource base is different for each subarea.

ECONOMIC DEVELOPMENT PROBLEMS

General

(1)* There is a decline in the supply of natural resources available for economic development in the basin. This results in limited basic extractive industry employment and low per capita personal incomes. As basic industry employment and income declines, the source of out-of-basin money decreases and funds for buying goods and services that are produced outside the basin decrease. As a result, all derivative employment declines and people either migrate out of the area or become unemployed and economic standards of living for those who remain behind are generally depressed from what they had been. Forestry and related activities are a major part of the economic activity in the basin. The area of harvestable commercial forest is declining in all three economic subareas. Harvestable timber supplies are also decreasing.

In the Upper Clark Fork subarea, the major economic activity is related to mining and metal reduction--principally for copper. Depletion of the higher-grade ores, changes in technology, and low copper prices are factors resulting in reducing the employment and the population of the subarea.

In the Flathead subarea, considerable acreages of forest and agricultural lands have been subdivided. Not all the subdivisions have taken land out of former uses yet, but many have. More than half of all the wilderness or roadless lands are in this subarea.

In the Lower Clark Fork subarea, declines in both commercial forests and arable land are also occurring, but with potentially more drastic effects because the subarea has less arable land and more employment in wood and paper products manufacturing than the other two subareas.

Thus there is a decline in the natural resource base in all three subareas which could seriously alter the economic stability of the basin.

Total per capita income in 1970 was $3,025 compared with $3,381 for Montana and $3,921 for the United States.1/ These figures indicate that per capita income in the basin is 23 percent below the national average.

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*A parenthesized number is provided for each problem and appears throughout the report to assist the reader. Each topic of concern is numbered the same in each chapter and in the summary tables.

1/ U. S. Department of Commerce--Regional Economics Information System

MAP III 1

ECONOMIC AND HYDROLOGIC STUDY AREAS

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

Source
Base map prepared by [illegible]
Thematic data prepared by [illegible]
U.S. DEPARTMENT OF A[illegible]

V7 PL-23425-28

Floodwater Damages

(2) Large floods of generally basin-wide significance have occurred in the Clark Fork drainage in 1894, 1908, 1948, 1964, 1974, and 1975. The flooding in 1908 and 1964 was particularly severe in terms of economic loss, especially to transportation systems.

Agricultural flood damages

Flooding has affected about 10,470 acres of agricultural land in the Lower Clark Fork subarea. About 16,920 acres have been affected in the Upper Clark Fork subarea and about 43,640 acres in the Flathead subarea.*/ Damages to irrigation ditches and diversions, fences, roads, culverts, and bridges are more costly than damages to crops and pasture because most flooding occurs during spring snowmelt runoff before crops are growing.

Urban and residential flood damages

The most serious urban and residential flood damages have been associated with major floods on the larger rivers. Along the Flathead River, significant flood damages have occurred at Columbia Falls and the unincorporated community of Evergreen. The Clark Fork has flooded the Orchard Homes area near Missoula. Other areas in the basin that have experienced some degree of flood damage in the past are Deer Lodge (Cottonwood Creek); St. Regis (St. Regis River); Lincoln (Blackfoot River); Lolo (Lolo Creek); Butte (Sand Creek and Blacktail Deer Creek); Anaconda (Warm Springs Creek); Swan River subdivisions (Swan River below Swan Lake); Missoula (Pattee Creek, Rattlesnake Creek, and Grant Creek); Kalispell (Spring Creek); and Drummond (Edwards Gulch). Most of these floods are caused by snowmelt, although some are caused by ice jams and occasionally by heavy rains. Residential encroachment on flood plains is continuing.

Impaired Drainage

(3) Areas with low agricultural production because of impaired drainage associated with irrigation were identified along the Little Bitterroot, Flathead, Clark Fork, and Bitterroot Rivers, on Camas Prairie, on the Flathead Irrigation Project, Nevada Creek, and along Flint Creek. These high water table problems stem from excessive irrigation, canal seepage, and lack of adequate drainage outlets. Some other wet areas occur naturally.

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*/ Adapted from data prepared for the Columbia-North Pacific Region Comprehensive Framework study.

Circular 39 published by the U. S. Fish and Wildlife Service provides a classification for 20 types of wetland in the nation. Seven of these types occur in the basin. Types I, II, III, and IV have been inventoried and are designated with small red numbers on map III-2. About 109,800 acres of types I and II and about 27,800 acres of types III and IV wetlands were inventoried. Locations which have more detailed drainage studies in SCS files are also shown with small red numbers followed by the letter "D". The following definitions for the four wetland types are quoted from Circular 39.

Type I--Seasonally flooded basins or flats. The soil is covered with water or waterlogged during variable seasonal periods but usually is well drained during much of the growing season. Vegetation varies greatly according to the season and duration of flooding.

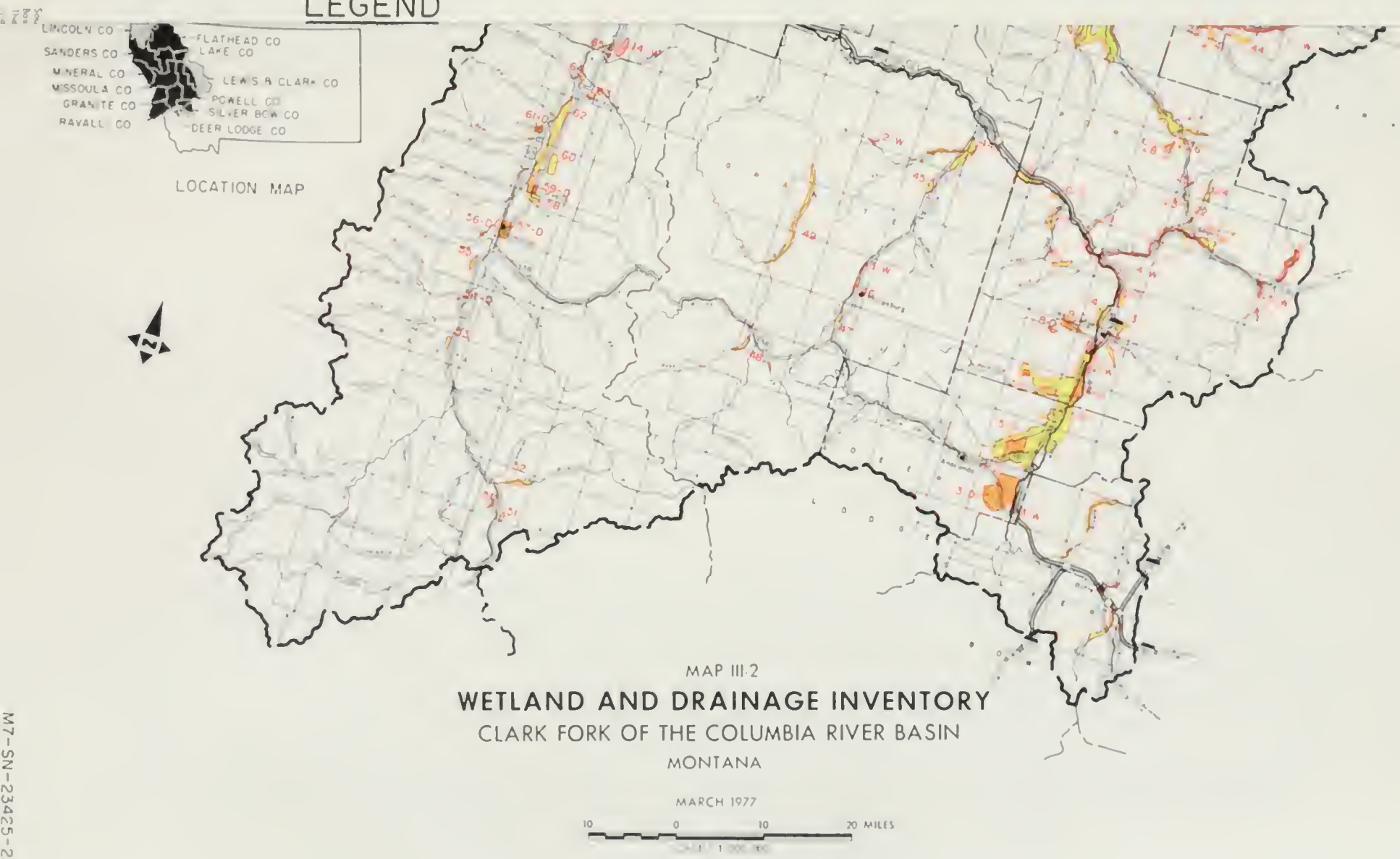
Type II--Inland fresh meadows. The soil usually is without standing water during most of the growing season but is waterlogged within at least a few inches of its surface. Vegetation includes grasses, sedges, rushes, and various broad-leaved plants.

Type III--Inland shallow fresh marshes. The soil is usually waterlogged during the growing season; often it is covered with as much as six inches or more of water. Vegetation includes grasses, bulrushes, spikerushes, and various other marsh plants such as cattails, arrowheads, pickerelweed, and smartweeds. In combination with deep, fresh marshes (Type IV) they constitute the principal production areas for waterfowl.

Type IV--Inland deep fresh marshes. The soil is covered with six inches to three feet or more of water during the growing season. Vegetation includes cattails, reeds, bulrushes, spikerushes, and wildrice. (Open areas with aquatic plants also occur.) Deep fresh marshes constitute the best breeding habitat in the country and they are also important feeding places.

Water Shortages

(4) Specific problems of late-season or temporal shortage of irrigation water were identified in the Flathead Irrigation Project, Flint Creek, Deer Lodge Valley, part of the Bitterroot Valley, Blackfoot and Little Blackfoot Valleys, and upper Flathead Valley. About 208,000 acres now irrigated have some late-season shortages of about 340,000 acre-feet at least two years in an average ten-year period. Nearly all irrigated lands will be short of water in a very dry year. Very little canal lining has been installed and ditch seepage losses are high. Rough topography, small acreages served, differences in water appropriation dates, and personal attitudes tend to



MAP III-2

WETLAND AND DRAINAGE INVENTORY

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

M7-SN-23425-23

Circular 39 published by the U. S. Fish and Wildlife Service provides a classification for 20 types of wetland in the nation. Seven of these types occur in the basin. Types I, II, III, and IV have been inventoried and are designated with small red numbers on map III-2. About 109,800 acres of types I and II and about 27,800 acres of types III and IV wetlands were inventoried. Locations which have more detailed drainage studies in SCS files are also shown with small red numbers followed by the letter "D". The following definitions for the four wetland types are quoted from Circular 39.

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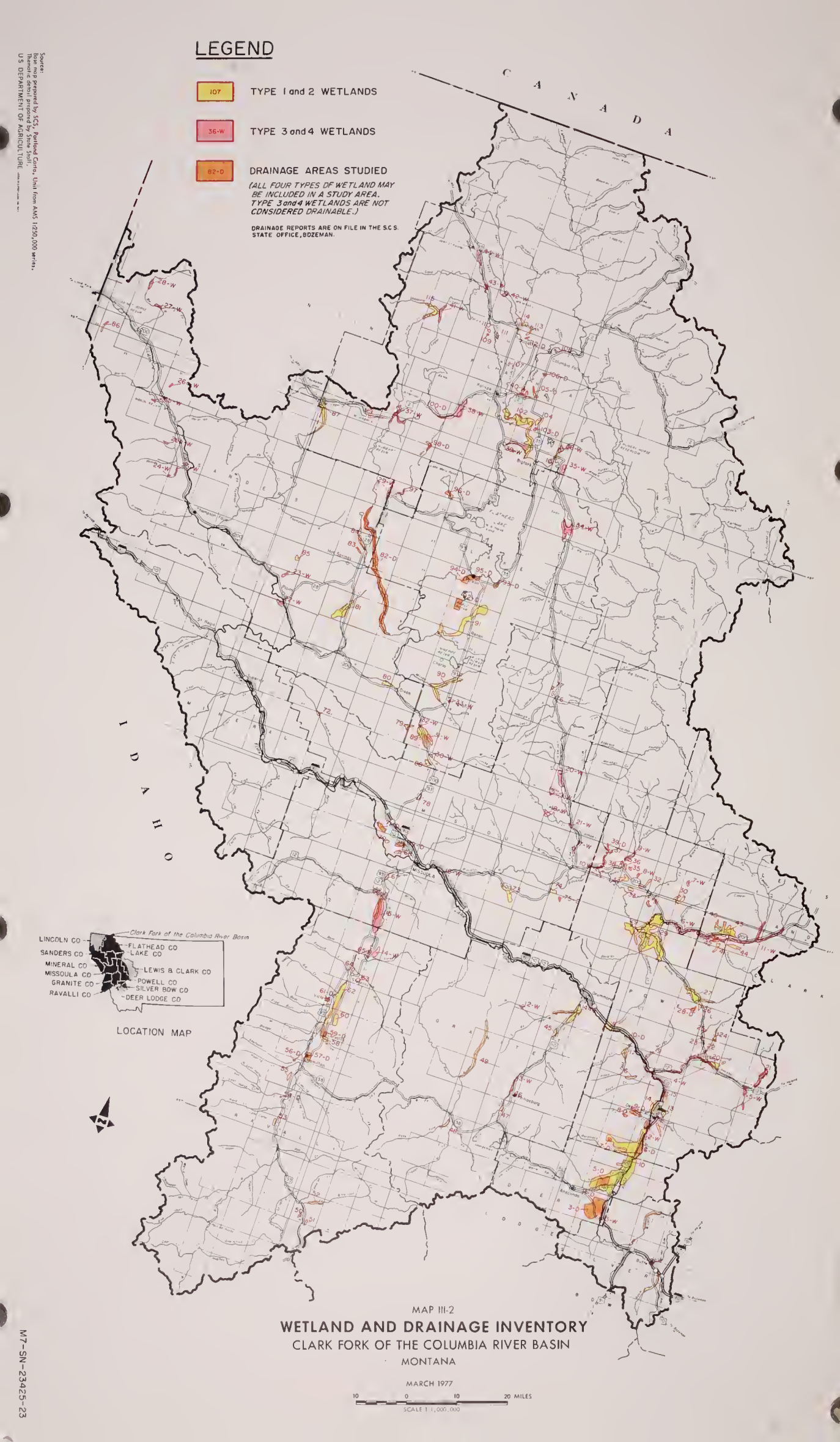


Source:
Base map prepared by SCS, Portland Cartog., Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.
U.S. DEPARTMENT OF AGRICULTURE

MAP III-2

WETLAND AND DRAINAGE INVENTORY

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

M7-SN-23425-23

hinder ditch consolidation or improvements in structural measures. However, much of the water lost in transmission returns to the stream system and is rediverted downstream so that the overall efficiencies of the stream systems are actually not as low as they first appear, even though dewatering occurs in short reaches of many smaller streams.

Livestock and rural domestic water supply is generally adequate in quantity and quality, but some shortage of water in some locations results in poor grazing distribution on rangeland.

Phreatophytes on ditch banks are a minor problem in irrigation projects. Phreatophytes along natural waterways are not considered a serious problem in this basin.

Municipal Water Supplies

(5) While drinking water quality for municipalities in the basin is generally good to excellent, some water sources have taste, odor, and color (sediment) problems. Few municipalities experience problems with water quantity, but problems of inadequate storage and distribution systems are widespread in the basin. Table III-1 lists the communities having problems with their systems. In addition, several communities now have no public water supply system.

Recreation Problems

Problems related to outdoor recreation in the study area include:

(6) Imbalanced supply of recreation services on public land. The location, types, and standards of existing services do not satisfy current preferences.

(7) Insufficient supply of recreational facilities in and near urban areas.

The Montana Department of Fish and Game conducted a statewide survey of urban recreation programs and facilities in 1973. That study found the following shortages of facilities in the basin.

Facility	Shortages
Baseball fields	14
Outdoor basketball courts	14
Outdoor tennis courts	11
Swimming areas	1
Wading pools	9
Stages	1
Meeting rooms	1
Playgrounds	3
Picnic areas	4
Gymnasiums	3
Craft rooms	2
Handball courts	6

TABLE III-1--MUNICIPAL WATER PROBLEMS
CLARK FORK OF THE COLUMBIA RIVER BASIN

Community	Problems
Butte	Uncovered west side reservoir
Deer Lodge	Short supply and lack of chlorination
Phillipsburg	Pipelines too small
Drummond	Lacks a central system
Garrison	Lacks a central system
Hamilton	Inadequate supply
Stevensville	Seasonal turbidity in surface supply
Missoula	Seasonal turbidity in surface supply
Alberton	Inadequate supply and distribution system
Superior	Inadequate distribution system
Essex	Inadequate distribution system
West Glacier	Inadequate supply and storage
Coram	Inadequate storage and distribution
Martin City	Inadequate supply, equipment, and distribution
Columbia Falls	Inadequate storage for ground-water supply
Somers	Inadequate supply
Red Gate	Inadequate equipment and distribution
Lakeside	Inadequate distribution
Hot Springs	Inadequate storage and distribution
Ronan	Inadequate supply and distribution
St. Ignatius	Two systems for one community
Plains	Inadequate supply
Thompson Falls	Seasonal turbidity and inadequate supply
Trout Creek	Inadequate storage

Source: Montana Department of Natural Resources and Conservation and Montana Department of Health and Environmental Sciences

(8) Low income of many private outdoor recreation enterprises.

(9) Insufficient number of entry points onto public lands, streams, and lakes. This limited access results in over-concentrated use in certain areas of the basin.

(10) Difficult boating access on some lakes and reservoirs with fluctuating water levels. Recreational problems associated with fluctuating water levels have been identified in the following lakes and reservoirs: Whitefish, Flathead, Little Bitterroot, Ashley, Como, Hungry Horse, Painted Rocks, East Fork of Rock Creek, Nevada Creek, Lower Willow Creek, and Georgetown. This is partly because most of the reservoirs and lake level control structures were not built for recreational purposes. The kettle lakes area north of Bigfork has a rising water table that is inundating boat docks and structures built too close to the lake shores. There are insufficient access points for boats on white-water streams. Except for these problems, the basin is well endowed with outdoor recreation opportunities.

Improper Land Management and Use

(11) Poor land management such as overgrazing, lack of weed control, and failure to prevent erosion reduces agricultural production while improper timber management reduces wood production. Some of the reasons for improper land management stem from smaller than economic farm units that have insufficient income to apply adequate land treatment. Other reasons include rural residents without equipment or knowledge of land treatment and often with more livestock than their small acreages can support. Much of the tribal-owned rangeland on the Flathead Indian Reservation is overgrazed and poorly managed. Many timber management practices are not economically feasible at current lumber prices and interest rates in situations with timber rotation cycles greater than 60 years.

(11a) About 319,130 irrigated acres, including the 208,000 acres short of late-season water, are not producing up to their agricultural potential. These 319,130 acres have improper water management and low water-use efficiencies.

(11b) Range management problems are directly related to lower than potential forage production and some areas are overgrazed to the point of being erosion hazards. About 640,000 acres lack planned grazing systems.

(11c) Forested lands producing less than their economic potential in 1970 included 4,200,000 acres out of 7,823,000 acres of total commercial forest. This less-than-potential production contributes to the depressed level of income because of decreasing amounts of large-diameter timber and underuse of lower-quality wood.

(12) About 84,000 acres of "other" lands such as farmsteads, roads, subdivisions, gravel bars, and industrial sites are eroding or are in danger of erosion.

Energy Facility Problems

(13) At present, the basin is a net importer of electrical power and has no developed natural gas, petroleum, or coal. There are some minor deposits of these fossil fuels in proximity to Glacier National Park, but it is unknown whether they will ever be developed. There is a current shortage of electrical transmission facilities on the Flathead Irrigation Project to the extent that it causes delays in initially filling requests for sprinkler irrigation power facilities.

Subdivision and Problems

(14) Available evidence indicates that agricultural and forest land is being lost to subdivision at about 3,500 acres per year. This has been a frequently mentioned concern in public meetings. The Montana law intended to regulate subdivision has apparently not slowed small tract subdivision and the number of units subdivided into tracts just larger than 20 acres has increased. There are both positive and negative economic effects of subdivision. Positive effects include income to selling landowners, real estate brokerage fees, increased building activity, and increased real property taxes. Negative effects are reduction in agricultural and timber production, reduced hunting activity, reduced agricultural personal property taxes, and increased residential sprawl and associated road, transportation, and protection costs. Most subdivisions have not yet been developed as building sites and subdivided land standing idle is a common occurrence.

ENVIRONMENTAL QUALITY PROBLEMS

General

Individuals, agencies, and the general public have become more aware of existing undesirable environmental conditions and of ongoing deterioration of natural resources. Certain segments of the public have become less willing to accept environmental deterioration in exchange for additional goods and services in the marketplace. EQ problems identified here are expressions of that concern.

Erosion Damage and Sediment Production

(15) Erosion causes reductions in environmental quality. About 173,000 acres of dry cropland are identified as inadequately protected from erosion. About 84,000 acres of "other" lands are inadequately protected from erosion. "Other" lands include farm roads, farmsteads, rural residential tracts, subdivisions, industrial tracts, and barren lands. About 640,000 acres of range are in danger of erosion. This erosion produces sediment which pollutes streams, lakes, and reservoirs, and damages aquatic habitat. Approximately 62,000 acres and 2,500 miles of trails and roads on national forest land are inadequately protected from erosion.

(16) Sediment production is largely a function of vegetation and soil characteristics. Parts of three drainages in the basin have particularly high sediment yields. They are the Little Bitterroot and Camas Creek watersheds in Sanders County and the upper Blackfoot in Lewis and Clark County. About 52 miles of streambank are inadequately protected from erosion. Most of the basin's sediment yield comes from bank erosion on the mainstems and larger tributaries during spring runoff. Forest harvest roads, highways, utility lines, and recreation activities disrupt the natural ground cover and tend to contribute to increased runoff and sediment production in local areas. Map III-3 shows average rates of sediment yield for relatively undisturbed watersheds.

High sediment loads reduce the life of downstream reservoirs by replacing water storage capacity with sediment. Fine sediments adversely affect stream fisheries by filling the gravel spaces needed for aquatic organisms and fish spawning activity. In municipal watersheds, sediments reduce water quality. Improper logging and agricultural practices increase the amount of sediment delivered to streams and lakes. Much of these sediments also carries pesticides and other agricultural chemicals.

Pollution

Water pollution problems by type and source were identifed by the Montana Department of Health and Environmental Sciences and Montana Department of Fish and Game. Effects vary from mild to very severe in terms of aquatic habitat, recreational use, and visual appearance. The types of pollution identified include both point-source and non-point-source pollution.

(17) Point-source pollution is mostly sewage effluent and industrial wastes, including harmful chemicals and nutrients. Municipal and industrially caused water pollution is identified in table III-2. In some locations legal requirements for pollution control are not being met.

(18) Non-point-source pollution is mostly borne in runoff from agricultural, rural residential, and forested areas. Irrigation water return flow in particular carries sediments, harmful chemicals, and excessive nutrients into streams and lakes. This type of pollution is aggravated by poor practices such as poor irrigation water management.

Impairment of Natural Beauty

Problems listed here which relate to impairment of natural beauty are those most often mentioned at public involvement meetings. Agreement on quantification of these problems is difficult to obtain because natural beauty is subjective.

(19) Fluctuating water levels in reservoirs expose barren areas and mudflats. Dams, dikes, and riprap which are installed to control flood flows are considered by many as impairments to natural beauty. Conversely, without these structures, uncontrolled floods damage buildings and deposit unsightly debris, mud, and dirty water along flood plains.

(20) Agricultural, residential, and road encroachment on rivers, streams, and lakes has partially eliminated riparian vegetation in the basin.

(21) An insufficient number of access points to public lands, including wilderness and roadless areas, causes excessive use around existing access points. Destruction of vegetation, rutted trails, and litter in and around these areas impair the natural beauty.

(22) Natural open and green space has been adversely affected from a visual aspect by clearcutting in large rectangular blocks. Overgrazing and failure to prevent wind and other erosion also impair natural beauty.

(23) Flood control, hydroelectric, and irrigation storage reservoirs have impounded segments of previously free-flowing streams.

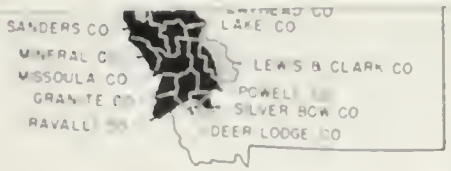
Fish and Wildlife Habitat Damage and Shortages

(24) Fish and wildlife habitat problems were identified by biologists and private individuals. Damages to the aquatic systems in the basin are due mainly to artificial dewatering of streams by irrigation water diversions. Low flows damage fish through loss of spawning and living habitat and seriously damage the food organisms upon which the fish populations depend.

(25) Fluctuating stream water levels and sudden water temperature changes are caused by power generation releases from Hungry Horse Reservoir. These daily changes disrupt spawning activity and aquatic food production in about 41 miles of the South Fork and mainstem of the Flathead River.

(26) Big game and waterfowl populations are declining in the basin. There are many reasons for these decreases, but loss and deterioration of habitat appear to be the major causes. Areas of big game winter range are decreasing due to land use changes such as subdivision encroachment and increasing grazing pressure by domestic livestock. Waterfowl habitat is decreasing due to drainage of wetland and use of adjacent feeding grounds.

LEGEND



LOCATION MAP

MAP III 3

GENERALIZED SEDIMENT YIELD

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

M7-SN-23425-26

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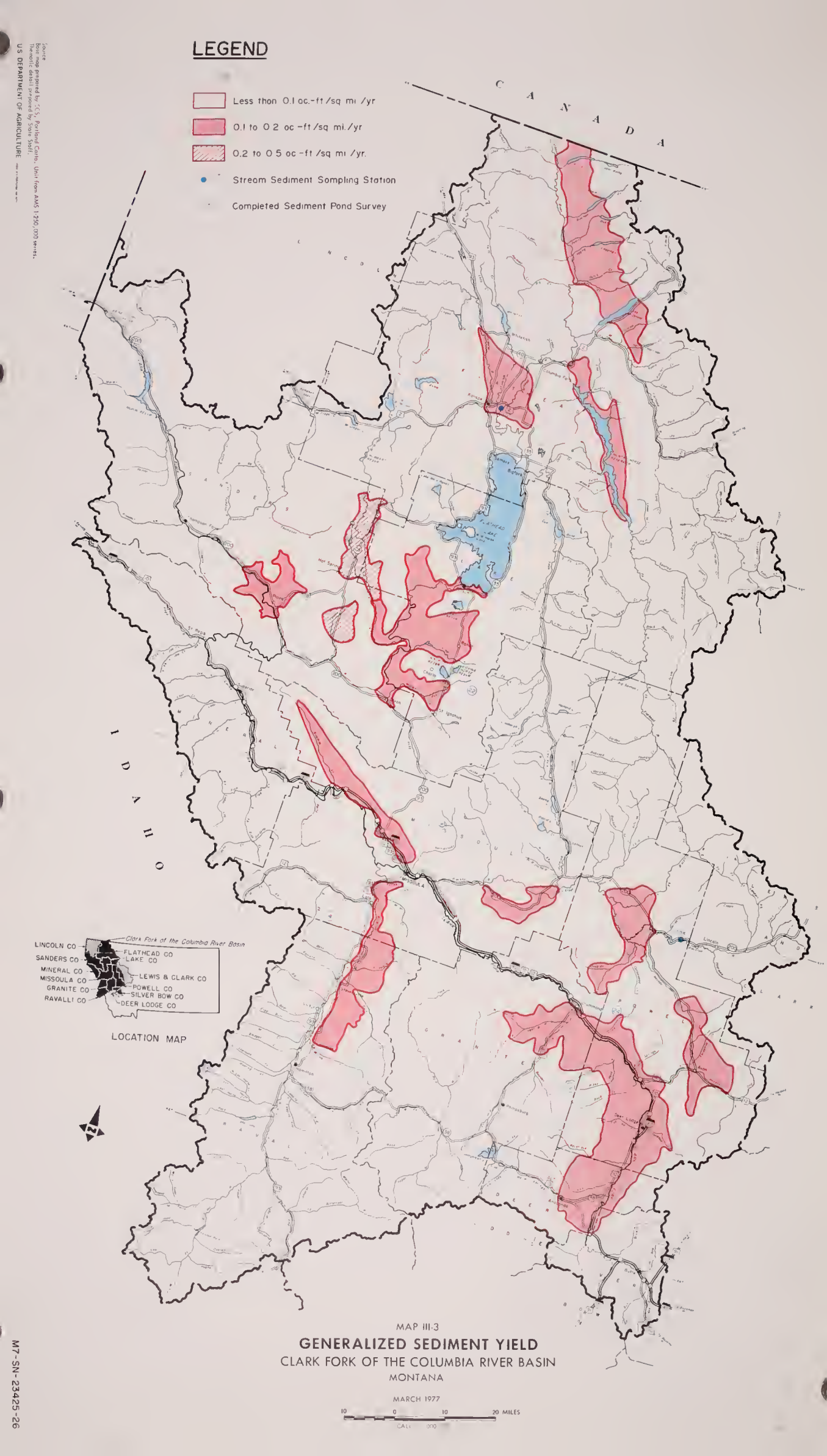

LEGEND
Less than 0.1 ac.-ft./sq mi /yr
0.1 to 0.2 ac -ft /sq mi./yr
0.2 to 0.5 ac -ft /sq mi /yr.
Stream Sediment Sampling Station
Completed Sediment Pond Survey
CANADA
IDAHO
Clark Fork of the Columbia River Basin
LINCOLN CO
SANDERS CO
MINERAL CO
MISSOULA CO
GRANITE CO
RAVALLI CO
FLATHEAD CO
LAKE CO
LEWIS & CLARK CO
POWELL CO
SILVER BOW CO
DEER LODGE CO
LOCATION MAP
Source:
Base map prepared by SCS, Portland Cartog. Unit from AMS 1:250,000 sheets.
Thematic detail prepared by State Staff.
U.S. DEPARTMENT OF AGRICULTURE
MAP III-3
GENERALIZED SEDIMENT YIELD
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10 0 10 20 MILES
M7-SN-23425-26

TABLE III-2--MUNICIPAL AND INDUSTRIAL WATER POLLUTION PROBLEMS
CLARK FORK OF THE COLUMBIA RIVER BASIN

Problem	Location		
Communities without central sewage facilities	Evergreen	Lolo	Georgetown Lake
	Lakeside	Swan Lake	Red Gate--Woods Bay
	Garrison	Ovando	Corvallis
	Somers	Arlee	Seeley Lake
	Ravalli	Opportunity	
	Plains	Lincoln	
	Rocker	W. Valley--Anaconda	
Communities without central secondary treatment	Polson	Darby	St. Ignatius
	Deer Lodge	Stevensville	Thompson Falls
	Drummond	Whitefish	
	Hot Springs	Elmo	
	Hamilton	Phillipsburg	Ronan
	Charlo		
	Kicking Horse Job Corps Center		
	Warm Springs State Hospital		
Industrial pollution			
Occasional spills from ponds near Warm Springs have caused fishkills in Upper Clarks Fork River	Anaconda Company		
Chemical discharges in Silver Bow Creek			
Sawmill waste leachate	Forest Products, Inc., Kalispell		
Organic wastes	Daily's Meats, Missoula		

Data Source: Montana Department of Health and Environmental Sciences

Many forms of wildlife are disrupted by residential encroachment on riparian habitat. Upland game populations seem to be declining due to habitat loss associated with modern farming practices and changes in cropping patterns which includes less grain farming in irrigated areas.

(27) Instream structures such as the Bigfork diversion dam are barriers to upstream migration of fish. The present fish ladder is ineffective due to improper installation.

(28) Subdivisions, especially of range and woodland, are decreasing big game habitat. The increased presence of people and their dogs impacts an area much larger than the subdivision. Subdivisions in all locations affect other forms of wildlife. Some species increase in numbers while others decrease. Few of the new buildings are designed to blend into the scenery. Where subdivisions are idle or untended, junk and litter frequently accumulate.

OBJECTIVES

This study has followed the procedures outlined in the U. S. Water Resources Council's Principles and Standards for Planning Water and Related Land Resources. These principles and standards define two major objectives to be attained through water and land resource planning. They are:

A. To enhance national economic development (NED) by increasing the value of the nation's output of goods and services and improving national economic efficiency.

B. To enhance the quality of the environment (EQ) by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resource and ecological systems.

Each of these major objectives is further defined in terms of first and second level specific components of objectives--the achievement of which will contribute to attainment of one or both of the major objectives.

The first level specific components as defined for this river basin for national economic development are:

a. increased output of food and fiber.

b. improved and increased recreational opportunities.

c. sustained and efficient use of resources.

d. sustained and improved forest products industry.

e. adequate supply of energy.

f. improved employment rates and personal incomes.

For the environmental quality objective, the first level specific components are:

a. enhancement of quality aspects of water, land, and air

b. management and protection of areas of natural beauty and human enjoyment

c. enhancement or preservation of biological resources

Second level specific components contribute to the achievement of one or more of the first level specific components and are directed at solving each of the problems presented earlier in this chapter. The parenthesized numbers below are the same as used for the list of problems. The second or detailed level components of objectives are listed in the remainder of this chapter.

NATIONAL ECONOMIC DEVELOPMENT OBJECTIVES

The following second level specific components have been identified to improve economic development of the basin to provide:

(1) Sustained basic industrial employment.

(2) Reduced flood damages on agricultural lands, transportation systems, and residential areas.

(3) Increased agricultural production on wet cropland now classed as types I and II wetlands where feasible.

(4) Improved irrigation water supplies to offset temporal shortages and improved irrigation distribution efficiencies.

(5) Improved municipal water supply systems.

(6) Improved supply, kind, and quality of recreational facilities and recreation management on public land.

(7) Additional or improved urban recreational facilities as needed.

(8) Increased economic education and technical assistance to owners of private outdoor recreation enterprises.

(9) Dispersed and improved quality of recreational activity along streams and on public lands in areas now blocked by private land.

(10) Boating facilities adapted to fluctuating water levels on reservoirs and white-water river sites.

(11) Improved efficiency of agricultural and commercial forestry production.

(12) Critical area treatment on "other" lands now eroding or endangered.

(13) Adequate electrical power and transmission lines.

(14) Identify better quality agricultural and forest lands that are significantly important to sustained use and protect these lands from being changed in use.

ENVIRONMENTAL QUALITY OBJECTIVES

The following second level specific components have been identified to improve and protect environmental quality in the basin to provide:

(15) Reduced erosion and sedimentation from range, cropland, forest, and other lands.

(16) Stable and uneroding streambanks.

(17) Reduced discharge of sewage effluent and industrial pollutants.

(18) Reduced chemical, nutrient, and thermal pollution from agricultural, forested, and residential lands.

(19) Reduced water fluctuations of reservoirs.

(20) Protected riparian vegetation along streams and lakes.

(21) Dispersed recreation on public lands.

(22) Protected open and green space.

(23) Free-flowing streams.

(24) Adequate minimum streamflows.

(25) Controlled temperature and reduced daily fluctuations of discharges from Hungry Horse Reservoir.

(26) Adequate big game, upland, and wetland wildlife habitat.

(27) Desirable fish migrations.

(28) Identification and protection of critical wildlife habitat and require that new buildings on existing subdivisions be constructed to blend with the scenery.

STATE IRRIGATIONAL EMPHASIS

In light of State policy to maintain and improve agriculture as the main basic industry, the State of Montana is concerned that sufficient water supplies be provided for all lands that can be economically irrigated. Montana Department of Natural Resources and Conservation has identified physically irrigable soils in the basin. They have also identified specific items for later economic and environmental evaluation that deal with irrigation. The State's objective is to complete economic feasibility studies of these proposals at a later date for use in funding development under their renewable resources program.

CHAPTER IV--ECONOMIC PROJECTIONS AND ENVIRONMENTAL PREFERENCES

HISTORICAL DEVELOPMENT

Before white men moved into western Montana, the area was inhabited by three major tribes of Indians--the Kootenai, Pend Oreille, and the Flathead. Fur trading occurred within the Clark Fork drainage shortly after Lewis and Clark passed through the area and was commercially important for a few years until the fur trade declined generally.

Some prospecting and mining has occurred in most regions of the drainage, but mineral extraction has predominated in the Upper Clark Fork area. By 1870 gold had dwindled, but silver in the oxidized state found in veins near the surface became commercially important when methods for its processing were developed. By 1883 a copper reduction plant was built at the present site of Anaconda.

Following the trappers and prospectors, immigrants arrived who were interested in making permanent settlements and who attempted to derive a livelihood from agriculture. The Bitterroot valley became the first permanently settled area in Montana in 1840. Livestock production has been the principal agricultural activity since the time of the first settlements.

At first, agriculture developed slowly in the study area. Creation of the Flathead Irrigation Project in the early 1900's gave impetus to agricultural growth in the northern part of the study area. The project serves land in Sanders, Lake, and Missoula Counties. Agricultural development was sporadic in the Bitterroot valley at first, with some small-scale irrigation works undertaken throughout the valley.

From the earliest days of settlement and mining in the study area, there developed a demand for forest products. The initial uses of logs were for mine timbers, fuel, and domestic construction. With the advent of the railroads there was a huge demand for rail ties. However, with the large stands of coniferous timber in the area, lumber was soon being sawed for export.

Other recent benchmarks in the historical development of the study area include the construction of Kerr Dam on Flathead Lake in 1938 with a generating capacity of 180,000 kilowatts. Hungry Horse Dam, completed in 1953, is another hydroelectric plant which impounds 3,500,000 acre-feet of water and has a generating capacity of 285,000 kilowatts. Other smaller units include Noxon Rapids, Thompson Falls, Bonner, Bigfork, Big Creek, and Flint Creek.

In 1953 the Anaconda Aluminum Company began construction of an aluminum reduction plant at Columbia Falls in Flathead County. The plant commenced production in 1955.

ECONOMIC ACTIVITY INDICATORS

The Clark Fork of the Columbia River Basin in Montana is an area which is mostly mountainous and forested. It contains contrasting and beautiful landscapes which draw increasingly large numbers of tourists to the area, large acreages of natural and improved grassland and hayland for a livestock industry, minerals for important mining and smelting operations, and forests to support timber and associated wood products industry.

Economic data needed for analyses are largely available on a county basis rather than a natural drainage basis. A county approach was used in defining economic boundaries in the "study area", including those counties whose major economic activity lies mostly in the basin area. The study area was then subdivided into three logical subareas similar to major drainage delineations (map III-1). The Flathead subarea includes Flathead and Lake Counties; the Lower Clark Fork subarea includes Missoula, Mineral, Sanders, and Ravalli Counties; and the Upper Clark Fork subarea includes Deer Lodge, Granite, Powell, and Silver Bow Counties. Economic data, unless otherwise stated, will pertain to these counties and these subareas. 1/

POPULATION AND SIGNIFICANT POPULATION CHARACTERISTICS

The 1970 population of the Clark Fork study area totaled 203,658 inhabitants. This population amounted to 29 percent of the total state population. The urban population in the study area consists of persons living in places of 2,500 inhabitants or more. The three largest cities are Missoula, 29,497; Butte, 23,368; and Kalispell, 10,526.

The 50-year average annual population growth rate has been roughly 0.7 percent, slightly higher than the state average of 0.5 percent for the same period, and considerably below the 50-year United States average of 1.9 percent. Between the years 1930-1940, the average growth rate of the study area was an even 1.0 percent per year. In subsequent decennial periods the average annual growth rate equalled 0.7, 0.6, and 0.8 percent, respectively.

1/ Additional data and information is reported in "Lynn W. Wilkes; The Economic Base of the Clark Fork of the Columbia River Basin, Montana, With Preliminary Projections to 1980, 2000, and 2020." USDA-ERS, Corvallis, Oregon, January 1975.

Population change has varied among the economic subareas of the Clark Fork. The most rapid and most consistent growth recently has occurred in the Flathead subarea. Population growth in the Lower Clark Fork subarea (which includes Missoula) has roughly paralleled that of the Flathead. Except for a small decline during the 1921-1930 period, there has been a consistent growth during the past 50 years. The Upper Clark Fork subarea has almost consistently declined in population during the past 50 years.

In 1970 about 47 percent of the total population of the study area was classified as rural and 53 percent urban, as defined by the Bureau of the Census. The 1930 rural-urban ratio for the study area was the same as the present ratio, and it has not varied greatly since that time. There has occurred, however, a modest increase in the number of the rural nonfarm population.

The Clark Fork study area is more densely populated than the average for the State of Montana as a whole, but is still very sparsely populated. The Flathead subarea is the least populated, with 7.8 inhabitants per square mile in 1970. The average density for the study area as a whole was 9.5 in 1970, compared with 57 persons per square mile nationally. However, a rather different picture unfolds if the subarea populations are divided by the taxable private land in each subarea.

Subarea	Population density based on total area	Population density based on private land
	Inhabitants per Square Mile	
Upper Clark Fork	12.1	27.8
Lower Clark Fork	9.1	28.6
Flathead	7.8	29.6
TOTAL BASIN	9.5	28.6

SOCIAL STRUCTURE AND INSTITUTIONAL ARRANGEMENTS

While eastern Montana, both historically and economically, is related to the Great Plains, western Montana, due to similarities in geographic

characteristics, resources, and economic activity, has had close ties with the states lying to the west and has been integrated as part of the Pacific Northwest.

In terms of the social structure of the study area, Indians exert their greatest influence in the Flathead subarea. The native Americans account for about five percent of the total population in the Flathead, 1.5 percent in the Lower Clark Fork, and 1.1 percent in the Upper Clark Fork. Other non-Caucasian groups account for less than one percent in all three of the subareas of the study area.

Property tax is the principal source of local governmental funding within the study area. Counties, municipalities, and school districts depend almost entirely upon this tax. There is no general sales tax for support of county or city government, although state government derives some revenues from selective sales taxes. Individual income and corporate taxes also support state government.

MAJOR TYPES OF ECONOMIC ACTIVITY AND EMPLOYMENT

An indicator of major importance--employment rates--reflects the major economic forces prevalent in the study area. Historic and current employment data serve a dual function. They outline the sectors which, in the past, have shown expansion or decline, and also provide the base and framework upon which employment projections are made. Two major sources of employment data are available--the Decennial Census and the Montana State Employment Security Division. Although both sources are used in this study, the data in the following paragraphs--for the study area and its subareas--are based primarily on Decennial Census data.

Employment trends generally parallel population. The employment participation rate (Employment/Population) for the study area is approximately the same as for the state, 34.0 and 35.2 percent respectively in 1970. This rate tends to be fairly uniform throughout the subareas of the Clark Fork.

Employment in the study area totaled 69,322 in 1970, including government employment, according to the Decennial Census. This was 28 percent of the total state employment. Since 1940, total employment for the study area has expanded at an average annual rate of 0.7 percent, increasing from 54,334 in 1940 to 69,322 in 1970 (table IV-1).

Agricultural employment in the study area has conformed to the national and state trends. Farm consolidation and enlargement and increasing mechanization have resulted in a decrease in agricultural employment--both

in absolute numbers and in percentage of total employment. Part-time farming is prevalent, with many farmers maintaining their farm residences but commuting to a nearby town or city for employment at least part of the year (table IV-2). Nearly half of the farm operators worked off their farms 100 or more days, and 35 percent of all operators had 200 or more days of off-farm employment in 1970.

Mining and primary metal industry (combined as one unit) was the largest basic industry employer in the basin in 1970 (table IV-1). Mining employment is concentrated in the Upper Clark Fork subarea where the open-pit copper mining operation is one of the primary economic activities. Employment in mining has declined significantly since 1940. Most of the mining activity of the subarea has been copper mining, although a nominal number of employees is engaged in mining of phosphate in Granite and Powell Counties. Some gold, silver, and sapphires are mined on a small scale. Sand and gravel are mined to meet construction needs.

Construction employment has shown considerable stability during the last decade, although the industry was highly volatile during the 1941-1960 period. Employment in the manufacturing industries in 1970 comprised 15 percent of total employment for the study area. The durable goods industries were dominant, with lumber and wood products and primary metals manufacturing being the primary employers.

The food and kindred products manufacturing sector has been the largest employer for the nondurable goods industries until recently when sugar beet processing was discontinued in the study area. Now the paper manufacturing industry employs more.

Employment in transportation and utilities increased through the period 1940-1960, declined slightly in the early 1960's, and increased during the latter 1960's. Growth in trade employment within the study area has been persistent throughout the 30-year period, 1941-1970.

Employment in the finance, insurance, and real estate sector has been characterized by extraordinary expansion. The growth rate over a 20-year period in the study area averaged three percent annually and far exceeded the growth in total employment for the same period. Employment in most of the service categories has shown modest expansion, except for employment in private households and medical and educational institutions. Medical and educational services employment has expanded rapidly and persistently.

TABLE IV-1--POPULATION, PARTICIPATION RATE, AND EMPLOYMENT, BY INDUSTRY, 1940-1970
CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	1940	1950	1960	1970
	Number			
Population	165,225	177,037	188,060	203,658
Participation rate (employment/population)	32.9	35.8	33.2	34.0
Total employment	54,334	63,353	62,449	69,322
Employment by industry:				
Agriculture, forestry, & fishery	9,667	8,841	6,267	5,524
Mining	8,464	6,484	4,064	3,419
Contract construction	2,515	4,222	3,387	3,921
Food & kindred products manufacturing	861	1,045	1,083	502
Lumber & wood products manufacturing	2,306	3,262	4,153	4,732
Printing & publishing	535	629	781	665
Chemicals & allied products manufacturing	36	65	254	282
Primary metals & fabricated metals	2,042	3,355	3,250	2,948
Machinery manufacturing	140	137	169	197
All other manufacturing	284	325	542	1,201
Transportation, communications, & public utilities	4,636	6,525	5,874	5,550
Wholesale & retail trade	8,946	12,013	12,560	14,891
Finance, insurance, & real estate	994	1,346	1,912	2,418
Lodging & personal services	2,197	2,441	2,130	2,703
Business & repair service	1,037	1,663	1,220	1,412
Entertainment & recreational services	531	621	504	524
Private households	1,187	919	1,453	851
Medical, educational, & others	4,131	6,079	8,830	14,571
Public Administration	3,006	2,256	2,913	3,011
Industry not reported	819	1,125	1,103	--

U.S. Census of Population.

TABLE IV-2--OFF-FARM EMPLOYMENT BY FARM OPERATORS, BY SUBAREA, 1969

CLARK FORK OF THE COLUMBIA RIVER BASIN

	Operators employed off-farm 100 or more days		Operators employed off-farm 200 or more days	
	Number	Percent of all farms	Number	Percent of all farms
Flathead	416	50.4	313	37.9
Lake	395	39.0	308	30.4
FLATHEAD SUBAREA	811	44.1	621	33.8
Missoula	158	48.3	124	37.9
Mineral	28	60.9	26	56.5
Sanders	195	51.9	158	42.0
Ravalli	391	45.5	304	35.3
LOWER CLARK FORK SUBAREA	772	48.0	612	38.0
Deer Lodge	33	49.3	32	47.8
Granite	28	20.0	18	12.9
Powell	42	24.9	31	18.3
Silver Bow	56	51.9	51	47.2
UPPER CLARK FORK SUBAREA	159	32.9	132	27.3
TOTAL STUDY AREA	1,742	44.3	1,365	34.7

U.S. Census of Agriculture.

Government employment, by all three levels of government, totaled 14,673 or 21.2 percent of all employees in 1970 (table IV-3).

TABLE IV-3--EMPLOYMENT BY GOVERNMENTS BY SUBAREAS--1970
CLARK FORK OF THE COLUMBIA RIVER BASIN

County and Subarea	Federal	State (estimated)	Local	Total
	- - - - - - - number of employees - - - - - - -			
Flathead	493	282	1,167	1,942
Lake	205	181	467	853
FLATHEAD SUBAREA	698	463	1,634	2,795
Mineral	57	57	218	332
Missoula	1,117	2,697	1,404	5,218
Ravalli	407	293	415	1,115
Sanders	129	106	319	554
LOWER CLARK FORK SUBAREA	1,710	3,153	2,356	7,219
Deer Lodge	101	1,071	322	1,494
Granite	26	83	91	200
Powell	11	406	243	660
Silver Bow	363	824	1,118	2,305
UPPER CLARK FORK SUBAREA	501	2,384	1,774	4,659
TOTAL STUDY AREA	2,909	6,000	5,764	14,673

Source: U. S. Census of Population

Unemployment is also an indicator of the economic activity in the basin. Unemployment in the basin is somewhat higher than the national average as shown by the following table.

TABLE IV-4--EMPLOYMENT AND UNEMPLOYMENT RATES, April 1, 1970

CLARK FORK OF THE COLUMBIA RIVER BASIN

Subarea	County	Labor Force	Employed	Unemployed	Percent Unemployed
Upper Clark Fork	Deer Lodge	5,692	5,288	404	7.1
	Granite	999	948	51	5.1
	Powell	2,466	2,332	134	5.4
	Silver Bow	15,504	14,543	961	6.2
	Subtotal	24,661	23,111	1,550	6.3
Lower Clark Fork	Mineral	1,216	1,047	169	13.9
	Missoula	23,168	21,349	1,819	7.9
	Ravalli	5,266	4,845	421	8.0
	Sanders	2,480	2.185	295	11.9
	Subtotal	32,130	29,426	2,704	8.4
Flathead	Flathead	13,725	12,278	1,447	10.5
	Lake	4,821	4,507	314	6.5
	Subtotal	18,546	16,785	1,761	9.5
Basin Total		75,337	69,322	6,015	8.0
United States Total		82,048,781	76,553,599	5,495,182	6.7

Source: County and City Data Book, U. S. Department of Commerce, 1972.

PERSONAL INCOME

Total personal income is payment received by individuals--both as payment for services, including labor, and as transfer payments from government and business, but not from individuals. Personal income may be measured either at the point at which income payments are made, or by considering total personal expenditures plus savings. However, this social account is somewhat more

inclusive than mere income payments to individuals in that personal income includes an estimate of the imputed value of rents on owner-occupied dwellings. Also, nonprofit organizations and private trusts, pension, health, and welfare funds are treated as persons in computing the personal income account.

The major components of personal income are earnings, property income, and transfer payments, the latter being payments such as unemployment insurance, social security, and general welfare payments. A deduction must be made for social security premiums paid.

Measured in current dollars, personal income in the Clark Fork study area totaled $628 million in 1970 (table IV-5). Transfer payments constituted about 12 percent of total income. The proportion contributed to total personal income by transfer payments was generally uniform among the subareas of the study area. Wages and salaries comprised nearly 84 percent of total earnings in the study area as a whole. This component did not vary significantly among the subareas, except in the Flathead subarea, where wages and salaries totaled 79 percent of total earnings. Proprietors' income comprised a greater proportion of total earnings--15 percent--in the Flathead than in the Lower and Upper Clark Fork subareas.

The period 1950-1959 was characterized by a decline in real personal income for the study area as a whole (figure IV-1). The decline averaged one percent per year for the period. The period 1959-1970 witnessed a reversal of the declining trend in the Lower Clark Fork, and all subareas experienced growth in real personal income. For the study area as a whole, per capita income in 1970 was $3,025, about 10 percent below the state per capita income. The study area was also considerably below the national 1970 per capita income of $3,921.

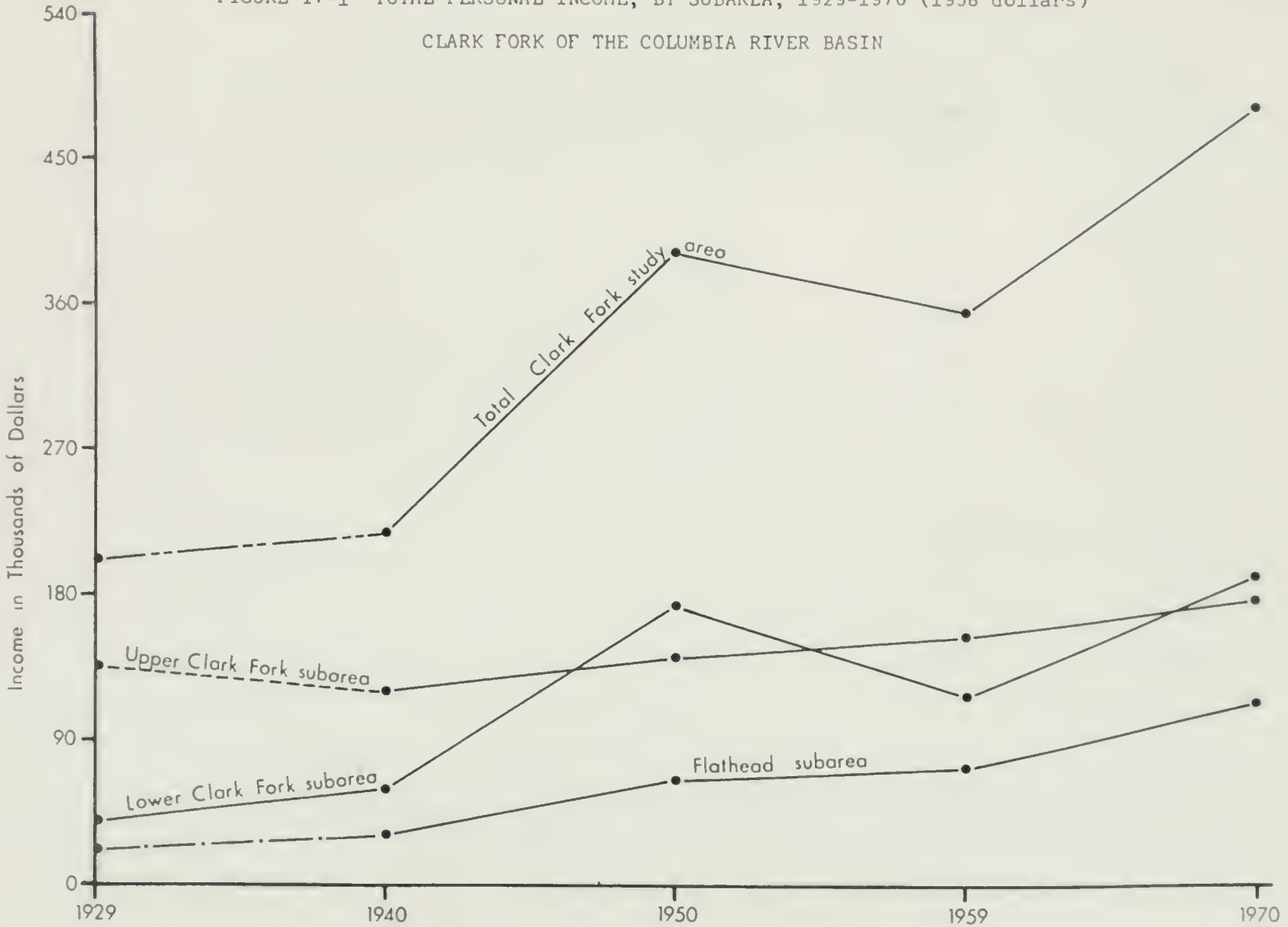
Mean family income for the study area in the base period was $9,454. Ten percent of the total number of families had incomes below the poverty threshhold established by the Federal Interagency Committee on Poverty. Mean family income was $8,821, $10,048, and $9,233 for the Flathead, Lower Clark Fork, and Upper Clark Fork subareas, respectively. The Flathead subarea had 12 percent of all families below the poverty level, while the Upper Clark Fork had 9 percent, and the Lower Clark Fork subarea had 10 percent.

TRANSPORTATION AND WAREHOUSING

Trucking transportation services are excellent throughout the state and in the Clark Fork study area. Four major airlines operate in the state of Montana and three in the Clark Fork study area. Major commodities transported by rail include farm products, food and kindred manufactured products, lumber and wood products, and primary metal products. This basin has a transportation disadvantage because of freight rate structures and distances to major market areas.

FIGURE IV-1--TOTAL PERSONAL INCOME, BY SUBAREA, 1929-1970 (1958 dollars)

CLARK FORK OF THE COLUMBIA RIVER BASIN



US Dept of Commerce – Regional Economics Information System

TABLE IV-5--PERSONAL INCOME, BY MAJOR COMPONENTS, BY SUBAREA--1970
CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Flathead Subarea	Lower Clark Fork Subarea	Upper Clark Fork Subarea	Total Clark Fork Study Area
		1,000 current dollars		
TOTAL PERSONAL INCOME	151,630	251,686	225,208	628,524
Earnings	113,885	191,023	167,655	472,563
Property income	24,685	42,915	37,260	104,860
Transfer payments	19,906	28,290	29,293	77,489
Less Social Security premiums	-6,846	-10,542	-9,000	-26,388
TOTAL EARNINGS	113,885	191,023	167,655	472,563
Wages and salaries	90,319	161,752	143,468	395,539
Other labor income	6,501	9,032	7,688	23,221
Proprietors' income	17,065	20,239	16,499	53,803
AGRICULTURAL INCOME				
Total cash receipts	23,077	17,723	13,003	53,803
FOREST PRODUCTS INDUSTRY				
Wholesale value of products	66,000	124,000	10,000	200,000

Source: U. S. Department of Commerce--Regional Economics Information System and Montana Agricultural Statistics

PRESENT ECONOMIC SITUATION

AGRICULTURAL AND RELATED ECONOMIC ACTIVITY

Agriculture is one of the leading industries in the basin. Livestock and livestock products are the principal sources of agricultural income, but field crops are important, particularly in the Flathead and Bitterroot valleys. Pasture and rangelands are extensive throughout the study area.

A major change in agriculture has been the consolidation of farms into larger and more economical units. Farm numbers have declined more rapidly in the Clark Fork study area than in the state as a whole. Farm numbers declined 27 percent in the study area between 1959 and 1969, compared with 25 percent for the state. Farm numbers have declined more rapidly in the Lower Clark Fork and Flathead subareas than in the Upper Clark Fork. The number of farms in the Clark Fork study area was 3,930 in 1969. Of this total, 1,837, or 47 percent, were in the Flathead subarea; 1,609, or 41 percent, in the Lower Clark Fork; and 484, or 12 percent, in the Upper Clark Fork.

In the decade 1959-1969, the average farm size for the study area increased 32 percent. Farms are smaller and more intensively cropped in the Flathead subarea. Farms in the Lower Clark Fork are considerably larger than those in the Flathead, and the average size farms within the Upper Clark Fork are more than four times as large.

Cropland and Major Crop Enterprises

Cultivated cropland comprises about 3.8 percent of the total land area. A land resource inventory recently conducted in the Clark Fork study area revealed only rather small changes in major land uses since the Soil and Water Conservation Needs Inventory was conducted in 1967. Total cultivated cropland increased about 11,000 acres in the study area. There have been, however, some significant shifts of land use within the cropland category. Since 1967 about 13,300 additional acres came under irrigation. Changes in irrigated acres occurred primarily within the Flathead subarea, with 9,800 additional irrigated acres and the remaining increase of 3,500 acres occurring in the Lower Clark Fork subarea. Table IV-6 gives the current normal irrigated land by major land use, and table IV-7 presents similar data for nonirrigated cropland. Current normal, as used here, is the average of data for 1968-1970.

Small grains and hay crops are predominant in the study area. Acreage of corn for silage is small. Barley crops are most prevalent among the small grains (table IV-8). Some malting varieties are grown, but most are feeding varieties. Irrigated wheat is mostly spring wheat, 65 percent, but 84 percent of total dryland wheat is winter wheat varieties.

TABLE IV-6--TOTAL IRRIGATED LAND, BY MAJOR LAND USE, BY SUBAREA, CURRENT NORMAL 1/

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Field crops			Rotation hay & pasture	Hay land	Total tillage rotation	Orchards	Total irrigated cropland	Irrigated permanent pasture	Irrigated range	Total irrigated land
	All row crops	Close grown crops	Total field crops								
	Acres										
Flathead.....	665	5,233	5,898	10,310	5,816	22,024	0	22,024	3,636	0	25,660
Lake.....	2,400	5,367	7,767	3,600	42,733	54,100	700	54,800	51,077	0	105,877
FLATHEAD SUBAREA..	3,065	10,600	13,665	13,910	48,549	76,124	700	76,824	54,713	0	131,537
Missoula.....	233	3,366	3,599	2,914	16,220	22,733	0	22,733	8,350	0	31,083
Mineral.....	0	300	300	0	1,300	1,600	0	1,600	37	0	1,637
Sanders.....	0	1,234	1,234	0	15,233	16,467	30	16,497	7,551	0	24,048
Ravalli.....	1,748	8,094	9,842	4,900	36,461	51,203	800	52,003	62,000	0	114,003
LOWER CLARK FORK..	1,981	12,994	14,975	7,814	69,214	92,003	830	92,833	77,938	0	170,771
Deer Lodge.....	793	1,683	2,476	500	14,433	17,409	0	17,409	7,694	0	25,103
Granite.....	0	1,533	1,533	0	32,967	34,500	0	34,500	7,186	0	41,686
Powell.....	653	3,620	4,273	3,820	54,880	62,973	0	62,973	11,460	0	74,433
Silver Bow.....	0	400	400	500	5,900	6,800	0	6,800	0	2,300	9,100
UPPER CLARK FORK..	1,446	7,236	8,682	4,820	108,180	121,682	0	121,682	26,340	2,300	150,322
CLARK FORK SUBAREA.	6,492	30,830	37,322	26,544	225,943	289,809	1,530	291,339	158,991	2,300	452,630

1/ Current normal is the average of data from 1968-1970 but does not include crop failure or non-pasture cropland grazed.

Clark Fork Type IV Soil Resource Group Survey.

TABLE IV-7--TOTAL NON-IRRIGATED CROPLAND, BY MAJOR LAND USE, BY SUBAREA, CURRENT NORMAL 1/

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Field crops				Rotation hay & pasture	Hay land	Conservation use only	Temporarily idle cropland	Total tillage rotation	Orchards & vineyards	Open land formerly cropped	Total non-irrig. cropland
	Row crops	Close grown crops	Summer fallow	Total field crops								
	Acres											
Flathead	110	39,406	16,690	56,206	11,932	14,067	597	1,217	84,019	0	1,990	86,009
Lake	0	17,434	11,344	28,778	0	20,900	645	2,076	52,399	0	1,000	53,749
FLATHEAD SUBAREA	110	56,840	28,034	84,984	11,932	34,967	1,242	3,293	136,418	350	2,990	139,758
Missoula	0	6,700	2,737	9,437	100	6,633	0	615	16,785	0	459	17,244
Mineral	0	877	385	1,262	0	1,567	0	0	2,829	0	0	2,829
Sanders	0	6,733	4,500	11,233	0	15,267	1,407	726	28,633	0	0	28,633
Ravalli	0	6,866	6,500	13,366	0	1,367	0	2,024	16,757	0	83	16,840
LOWER CLARK FORK	0	21,176	14,122	35,298	100	24,834	1,407	3,365	65,004	0	542	65,546
Deer Lodge	0	400	400	800	0	0	0	1,098	1,898	0	200	2,098
Granite	0	1,300	1,200	2,500	0	1,533	0	0	4,033	0	0	4,033
Powell	0	4,575	4,200	8,775	0	6,866	130	0	15,771	0	0	15,771
Silver Bow	0	0	0	0	0	1,700	0	30	1,730	0	0	1,730
UPPER CLARK FORK	0	6,275	5,800	12,075	0	10,099	130	1,128	23,432	0	200	23,632
CLARK FORK STUDY AREA	110	84,291	47,956	132,357	12,032	69,900	2,779	7,786	224,854	350	3,732	228,936

1/ Current normal is the average of data from 1968-1970 but does not include crop failure or non-pasture cropland grazed.

Clark Fork Type IV Soil Resource Group Survey.

TABLE IV-8--CROP ACREAGE AND PRODUCTION, BY SUBAREA, CURRENT NORMAL

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Prod. unit	Flathead subarea		Lower Clark Fork subarea		Upper Clark Fork subarea		Clark Fork study area	
		Acres	Production	Acres	Production	Acres	Production	Acres	Production
Winter wheat, total.....	Bu.	27,733	1,154,300	12,400	379,800	1,033	25,300	41,466	1,559,600
Irrigated.....	Bu.	1,833	95,300	834	47,800	0	0	2,667	143,100
Non-irrigated.....	Bu.	25,900	1,059,200	11,566	332,000	1,033	25,300	38,499	1,416,500
Spring wheat, total.....	Bu.	6,234	193,900	3,651	107,800	2,766	104,200	12,651	405,900
Irrigated.....	Bu.	2,000	79,700	1,567	59,900	1,866	83,900	5,433	223,500
Non-irrigated.....	Bu.	4,234	114,200	2,084	47,900	900	20,300	7,218	182,400
Oats for grain, total.....	Bu.	4,399	236,600	2,883	140,500	2,251	111,100	9,533	488,200
Irrigated.....	Bu.	1,466	92,900	1,400	82,800	1,717	90,800	4,583	266,500
Non-irrigated.....	Bu.	2,933	143,700	1,483	57,700	534	20,300	4,950	221,700
Barley for grain, total.....	Bu.	26,700	1,321,200	12,834	655,500	6,867	272,030	46,401	2,248,730
Irrigated.....	Bu.	5,100	306,700	7,700	459,700	3,434	160,300	16,234	926,700
Non-irrigated.....	Bu.	21,600	1,014,500	5,134	195,800	3,433	111,730	30,167	1,322,030
Corn for silage, total.....	Ton	434	6,600	666	11,641	0	0	1,100	18,241
Irrigated.....	Ton	434	6,600	666	11,641	0	0	1,100	18,241
Non-irrigated.....	Ton	0	0	0	0	0	0	0	0
Irish potatoes, irrigated...	Cwt	2,632	620,200	615	127,100	1,446	264,500	4,693	1,011,800
Hay, all.....	Ton	107,999	208,855	103,866	238,867	123,100	225,126	334,965	672,848
Irrigated.....	Ton	59,266	135,171	77,932	203,569	113,000	212,166	250,198	550,906
Non-irrigated.....	Ton	48,733	73,684	25,934	35,298	10,100	12,960	84,767	121,942
Alfalfa, all.....	Ton	66,099	142,716	57,066	152,693	35,766	89,759	158,931	385,168
Irrigated.....	Ton	34,866	92,918	41,200	129,752	32,933	85,625	108,999	308,295
Non-irrigated.....	Ton	31,233	49,798	15,866	22,941	2,833	4,134	49,932	76,873
Other hay, total.....	Ton	41,900	66,139	46,800	86,174	87,334	135,366	176,034	287,679
Irrigated.....	Ton	24,400	42,253	36,732	73,817	80,067	126,540	141,199	242,610
Non-irrigated.....	Ton	17,500	23,886	10,068	12,357	7,267	8,826	34,835	45,069
Sugar beets, irrigated.....	Ton	0	0	700	12,600	0	0	700	12,600
Apples, total.....	Lbs.	140	255,000	453	438,600	0	0	593	693,600
Irrigated.....	Lbs.	90	180,000	453	438,600	0	0	543	618,600
Non-irrigated.....	Lbs.	50	75,000	0	0	0	0	50	75,000
Sweet cherries, total.....	Lbs.	910	6,144,000	372	2,976,000	0	0	1,282	9,120,000
Irrigated.....	Lbs.	610	4,944,000	372	2,976,000	0	0	982	7,920,000
Non-irrigated.....	Lbs.	300	1,200,000	0	0	0	0	300	1,200,000
Pears, irrigated.....	Lbs.	0	0	5	6,000	0	0	5	6,000
Cropland pasture, total.....	AUM	4,140	17,100	193	1,200	0	0	4,333	18,300
Irrigated.....	AUM	3,800	16,700	193	1,200	0	0	3,993	17,900
Non-irrigated.....	AUM	340	400	0	0	0	0	340	400
Permanent pasture, total....	AUM	103,245	252,900	110,771	346,492	47,745	120,114	261,761	719,506
Irrigated.....	AUM	54,713	210,400	77,938	319,800	26,340	97,100	158,991	627,300
Non-irrigated.....	AUM	48,532	42,500	32,833	26,692	21,405	23,014	102,770	92,206
Range, total.....	AUM	224,392	59,400	420,899	109,963	835,765	246,159	1,481,056	415,522
Irrigated.....	AUM	0	0	0	0	2,300	7,500	2,300	7,500
Non-irrigated.....	AUM	224,392	59,400	420,899	109,963	833,465	238,659	1,478,756	408,022
Private forest land grazed..	AUM	327,270	48,784	850,962	88,326	429,671	85,970	1,607,903	223,080
Federal land grazed	AUM								27,460

Montana Agricultural Statistics and Clark Fork Soil Resource Group survey.

Seed potatoes provide a good cash crop for a few producers. Sweet cherries are the primary fruit crop grown around Flathead Lake and tart cherries are the main fruit crop in Ravalli County.

Hay crops occupy by far the most acres of cropland in the study area. The trend has been toward alfalfa hay, with reduction in miscellaneous hays. Wild hay has been important in the past. Much of the acreage of wild hay has been improved, and domestic species have been introduced for higher yields.

Major Livestock Enterprises

The overall trend in livestock numbers in the study area generally follows the national trend of increasing numbers of beef cows and declining numbers of sheep and lambs. Numbers of cows kept for milking have declined consistently. In the Clark Fork study area, the cattle inventory decreased from 317,300 in 1972 to 314,800 in 1973 and then expanded to 323,000 in 1974. As of January 1, 1972, there were 6,400 head of cattle on feed within the Clark Fork study area. About 90 percent of that number were in Flathead, Powell, and Ravalli Counties.

Volume and Value of Agricultural Output

For analytical purposes the agricultural sector has been disaggregated into seven subsectors. Six of them are crop or livestock producing and one is an agricultural services category. In 1970 the total value of output for the group of agricultural sectors totaled $70,112,000 (table IV-9). This figure exceeds farm sales ($51,341,500) as some output is not marketed directly, but becomes factor inputs for other enterprises such as feed to livestock. Value of products consumed on the farm is also included in total farm output. Essentially, this methodology is based upon the farm enterprise type of accounting and will be part of an interindustry input-output analysis.

The range livestock enterprise accounted for almost half of the value of agricultural output in 1970. Field crops other than cash grains ranked second in terms of value. The Flathead subarea had 42 percent of the total value of production; the Lower Clark Fork, 35 percent; and the Upper Clark Fork, 23 percent. Nearly all feed for livestock in the basin is produced in the basin.

TABLE IV-9--VALUE OF AGRICULTURAL OUTPUT, BY SECTOR, 1970

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Amount	Percent of Total
	1,000 dollars	
Livestock (range and pasture-fed)	29,773	42.5
Fed cattle	2,207	3.1
Dairy	4,952	7.1
Cash grain	4,622	6.6
Other field crops	23,365	33.3
Agricultural services	1,947	2.8
All other agriculture	3,246	4.6
TOTAL	70,112	100.0

Source: Montana Agricultural Statistics and Other

Agricultural Employment and Income

In 1970 farm wage and salary employment totaled 1,180 persons. An additional 187 were employed in agricultural services and 112 in forestry enterprises (does not include logging or wood products under Standard Industrial Classification category). In addition to the wage and salary employees, there were approximately 3,930 farm proprietors who were mainly actively engaged in the operation of farms and ranches. A related factor is off-farm employment by farm operators in the study area (table IV-2). Wages and salaries from farm and farm-related sources are rather small in the context of the entire economy of the study area. Only in the Lower Clark Fork did they exceed two million dollars. Total wages and salaries from farms and related services totaled $5,152,000 in 1970.

Employment and Income in Related Trade Service and Processing Industries

Transactions in the agricultural sector--marketing of agricultural products or purchasing supplies or equipment--triggers economic activity in other sectors of the economy. Trade, processing, and service sectors most closely related to agriculture within the study area are the food and kindred products manufacturing sector, the transportation sector, the trade sectors, particularly gasoline retail outlets and farm machinery dealers, financial institutions, and selected services (table IV-10).

TABLE IV-10--EMPLOYMENT AND EARNINGS IN AGRICULTURALLY RELATED INDUSTRIES
1970

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Employment 1/	Earnings
	Number	1,000 dollars
Food & kindred products	670	5,206
Retail trade		
Building materials & farm equipment	409	2,779
Automotive dealers & service stations	2,208	2,638
Finance, insurance, and real estate	1,856	2,784
Utilities	760	8,854
Services	10,420	58,854
Transportation	3,136	37,378

1/ In some instances, these data are not comparable to census data in table IV-1 because these are employment covered by unemployment compensation.

Capital Investment

The major capital investments are in land and buildings. In the Clark Fork area these investments exceed the state average when viewed from a per-acre-in-farms perspective, but are considerably below the state average on a per-farm basis. Data in table IV-11 highlight some of the characteristics of farm values in the study area.

Upward pressures in real estate values appear, in general, to be closely correlated with earnings from farm and ranch production. Markets are highly localized in nature, however, and in some areas nonfarm demands, such as subdivisions for summer homes, etc., have a greater impact on farm real estate values than does present or potential agricultural production.

TABLE IV-11--VALUE OF LAND AND BUILDINGS IN FARMS, BY SUBAREA, 1969

CLARK FORK OF THE COLUMBIA RIVER BASIN

Subarea	Total	Average per farm	Average per Acre in Farms
	1,000 current dollars	- - - - - Current dollars - - - -	
Flathead	136,920	74,534	142.00
Lower Clark Fork	139,061	86,426	119.45
Upper Clark Fork	101,772	210,272	70.10
Total Study Area	377,753	96,120	105.53

TIMBER RESOURCES AND RELATED ECONOMIC ACTIVITY

About 77 percent of the Clark Fork study area is covered with forest vegetation and 75 percent of that forested area is capable of producing industrial quality wood. This large natural resource base supports a substantial wood products industry.

Utilization: Kind, Volume, and Value of Output

In spite of significant mortality, the annual harvest of timber has been considerably below the estimated annual allowable cut during the past several years. In 1970 the total harvested was approximately 75 percent of what was considered allowable according to the comparison of net annual growth of sawtimber on all ownerships (table IV-12). There are a number of reasons the harvest has not equaled the annual allowable cut. Some of the timber is found in marginal areas where harvesting costs are prohibitive. Weather, strikes, and fluctuations in the marketplace have also played their roles. More stringent environmental controls, limited funding for management, and delays to allow time for management planning have reduced and delayed timber harvest and management.

TABLE IV-12--INVENTORY, GROWTH, AND HARVEST RELATIONSHIPS ON COMMERCIAL FOREST LAND BY OWNERSHIP GROUPS--1970

Clark Fork of the Columbia River Basin

Concept	National Forest	Other Federal & State	Forest Industry	Farmer and Miscellaneous Private	All Ownerships
	- - - - - - - - - Millions of Cubic Feet - - - - - - - - -				
Growing Stock[1/]					
Inventory	9,300	1,580	1,490	2,490	14,860
Annual gross growth	269	33	30	57	389
Mortality (loss)	69	7	10	10	96
Net Growth	200	26	20	47	293
Potential gross growth	463	53	43	88	647
Sawtimber[2/]	- - - - - - - - - Millions of Board Feet - - - - - - - - -				
Inventory	31,600	6,170	6,910	9,620	54,300
Annual gross growth	838	138	134	218	1,328
Mortality (loss)	247	29	43	39	358
Net growth	591	109	91	179	970
Harvest	412.6	87.4	(- - - - 229.5 - - - -)		729.5

Source: Forest Survey and River Basin Staff

1/ All live trees 4.0 inches or larger in diameter. These data are used in forest management.

2/ All live trees 9.0 inches or larger in diameter (d.b.h.). These data have been used in timber harvest. Recently the harvest criteria have changed to allow the harvest of 8 inches d.b.h. trees for all but lodgepole pine and 7 inches d.b.h. lodgepole pine as sawtimber.

Eighty-five percent of the timber harvested from the forest land in the Clark Fork study area was used as sawlogs for lumber production while the rest was used for veneer logs, pulpwood, and other uses. Some logging residues, which in the past would have been left in the forest, were also removed. This and other removals are not accounted for in the sawtimber inventory and amounted to about a 10 percent extension of the output from the resource (table IV-13).

TABLE IV-13--HARVEST FROM SAWTIMBER INVENTORY BY PRODUCT ON COMMERCIAL FOREST LAND--1970

CLARK FORK OF THE COLUMBIA RIVER BASIN

Product	Million Board-Feet	Percent of Total
Sawlogs	621.9	85.3
Veneer logs	97.1	13.3
Pulpwood	3.5	.5
Commercial poles	1.6	.2
Mine timbers	2.2	.3
Miscellaneous industrial wood 1/	1.4	.2
Posts, fuelwood, and miscellaneous farm timbers	1.7	.2
All products 2/	729.5	100.0
Logging residues 3/	59.3	8.1
Other removals 3/	13.4	1.2

Source: USDA Forest Service Resource Bulletin INT-10, 1974.

1/ Includes house logs, converter poles, piling, shingle bolts, excelsior bolts, match stock, charcoal wood, etc.

2/ Debit against inventoried volume.

3/ Not accounted for in inventory above because it is dead or too small

In considering the value of output, wood must be considered first as unprocessed sawlogs, or cordwood, and secondly as finished lumber, plywood, etc. Initially there is a stumpage charge, usually based upon the quality of the timber stand, the relative ease of harvesting, and location of the forest. The approximate raw material value of the wood removed in 1970

was 18.5 million dollars in 1967. The value added to this raw material as it was processed into lumber and plywood brought the wholesale value of this material to approximately 200 million dollars in 1972 dollars.

Employment and Income in Primary Processing

Employment and income in the primary wood products sector are mainstays of the economy of the study area. In 1970 there were 1,305 workers employed in logging camps and as logging contractors. Essentially, they produce rough primary forest or wood products. In addition, there were 4,370 employees in the wood processing industries such as sawmills, etc. Earnings for the loggers and logging contractors totaled $5.4 million in 1970 and earnings from other primary processing of wood products totaled $44.8 million.

Employment and Income in Related Trade and Service Industries

Basic industry to total industry employment multipliers were derived from census data for the study area and subareas. These multipliers approximate the relationship between forestry and forest products industry compared with total industry. These multipliers were used to develop data in table IV-14.

TABLE IV-14--FORESTRY AND RELATED INDUSTRY EMPLOYMENT

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Subareas			
	Flathead	Lower Clark Fork	Upper Clark Fork	Study Area Total
	- - - - - - - Persons - - - - - - - -			
SIC 24 1/	---	---	---	5,339
SIC 26	---	---	---	336
Forest Mgmt.	---	---	---	940
Total Basic Empl.	2,183	4,101	331	6,615
Secondary Empl.	2,870	5,008	325	8,203
Total Employment	5,053	9,109	656	14,818

Source: U. S. Census and River Basin Planning Staff 1970

1/ SIC = Standard Industrial Classification: SIC 24 includes logging, lumber, and wood products. SIC 26 includes pulp, paper, and allied products.

Data from table IV-14 were combined with levels of earnings in types of employment to develop tables IV-15 and IV-16, which show the relative economic importance of the forest industry to the income and employment of the basin.

TABLE IV-15--FORESTRY AND RELATED INDUSTRY EARNINGS
CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Subareas			
	Flathead	Lower Clark Fork	Upper Clark Fork	Study Area Total
	- - - - - - - - ($1,000) - - - - - - - -			
SIC 24 1/	---	---	---	38,099
SIC 26	---	---	---	3,143
Forest Mgmt.	---	---	---	7,165
Total Basic Empl.	15,975	30,012	2,420	48,407
Secondary Empl.	19,889	34,706	2,252	56,847
Total Earnings	35,864	64,718	4,672	105,254

Source: U. S. Census and River Basin Planning Staff 1970

Earnings from USDA Forest Service Research Paper INT-172,1975.

1/ SIC = Standard Industrial Classification

TABLE IV-16--IMPORTANCE OF FORESTRY INDUSTRY RELATED TO TOTAL INDUSTRY
CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Subareas			
	Flathead	Lower Clark Fork	Upper Clark Fork	Study Area Total
	- - - - Forestry Percent of Total - - - -			
1. Manufacturing Empl.	66	99+	10	66
2. All Basic Empl.	31	32	3	21
3. Wages & Salaries	40	40	3	27
4. Personal Income	24	26	2	17

Source: U. S. Census and River Basin Planning Staff 1970

Capital Investment in Forestry Industries 1/

Capital investments in mills and equipment have been increasing in most industries statewide. Almost without exception, lumber and wood products industries have led the field in new capital investment, accounting for over 25 percent of the state total in recent years. After such heavy expenditures for new miils and equipment, one would expect increases in productivity in terms of value added per employee hour, but such increases are not evident. Perhaps more lag-time is needed to bring out these gains--or perhaps the heavy investments have merely forestalled decline in labor productivity. Factors contributing to keeping labor productivity down include: decreased size of trees which reduces harvest and mill efficiency; shift of harvesting to more inaccessible and steeper sites which reduces harvesting efficiency; and stricter regulation of logging practices on public land to protect the environment which has increased costs and reduced harvest labor efficiency. Maximum production capacity of 1,094 million board-feet exceeded net growth, allowable cut, and actual cut for 1970.

OUTDOOR RECREATION

The Montana Department of Highways estimates that during 1971 approximately 3.77 million out-of-state tourists spent, on the average, about $40 per visit within the state. It is estimated that tourist expenditures exceeded $150 million in 1971. The study team estimates that as much as 25 percent of this total state expenditure could have taken place within the Clark Fork study area. About 22 cents out of each dollar spent by the "average" out-of-state tourist is estimated to become direct basic income to Montanans. 2/ On this basis, tourism provided about 8.25 million dollars in basic income to basin residents. Assuming $9,000 per man-year of employment, this would provide about 900 man-years of basic employment. The basic-to-total-employment multiplier is estimated at 2.24 for the study area. Thus, total employment impact attributable to tourism is estimated at 2,000 man-years of employment or about three percent of total employment in the basin. However, major weaknesses of tourist industry employment include seasonality and very low wages. In addition, many employees are out-of-state students who take much of their summer wages home with them.

The above estimate of "tourism" contains that sort of outdoor participation which brings new money into the study area. The current level of recreation participation in the study is estimated to be 14.9 million activity occasions as shown in table IV-22. A portion of this activity

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1/ Material paraphrased from A Profile of Forestry Employment in Montana, by Richard L. Porterfield, USDA Forest Service Research Paper INT-172, 1975.

2/ Polzin, Paul E., and Dennis L. Sweitzer, Economic Importance of Tourism in Montana, USDA Forest Service Paper INT-171, July 1975.

takes place in Glacier National Park which recorded 1.57 million visitors in 1975. Recreation on National Forest land was estimated at 10.2 million recreation days of use in 1975. Recreation days are not the same as activity occasions. 1/

For the four National Forests constituting the bulk of the forest land, the current budgets for recreation maintenance and recreation construction are $605,000 and $1,000 respectively.

Gross receipts and cost information are not available on private enterprise in outdoor recreation for the basin.

The 16 largest communities in the study area budget about $280,000 for recreation programs on 971 acres of urban parks. This budget amounts to about $290 per acre of urban park and represents an average of about $3 per person living within the limits of the same 16 cities.

AQUACULTURE

Aquaculture includes the practice of raising fish in closely managed areas. Two distinct segments of the aquaculture industry in this basin are considered in this report.

The first segment is concerned with the production of fish for conservation purposes such as the stocking of streams and lakes. This conservation segment is limited to three hatcheries operated by the Montana Department of Fish and Game, one federal hatchery operated by the U. S. Fish and Wildlife Service, and one private hatchery which is affiliated with the Confederated Salish and Kootenai Tribes. Approximately four and one-half million fish were raised by these five hatcheries during 1974 for stocking in streams and lakes.

The second segment is the commercial fishery which raises fish for market consumption and for stocking private fishing ponds. The first commercial fish business was started in the basin in the early 1930's.

1/ An activity day is any part of a day in which a person engages in an activity one or more times. A recreation day is different in that it is a person's visit to a site or area during any reasonable portion of a day regardless of his activities while there. For example, a person may spend a recreation day at a lakeshore campsite. While there he may go swimming twice for one activity occasion, fish for one period, water ski for another, picnic twice, and camp--for a total of five activity occasions.

Since then the industry has increased in size to a point where in 1974 there were three hatcheries and 17 commercial fish farms. During 1974 these facilities produced approximately three million small fish for stocking purposes and 80 thousand pounds of fish for the commercial market.

PRESENT ENVIRONMENTAL SITUATION

The present environmental quality of the basin is excellent in relation to environmental quality of most regions of the United States. Many areas can still be considered in pristine condition in that pollution is very minor. Because of the excellent environmental conditions, deterioration of environmental quality of a minor nature is readily recognized by the public.

LAND AND RELATED ENVIRONMENT

The Lewis and Clark expedition (1805-1806) noted in their journals that game was scarce in the mountain areas. During the 1930's the wildlife populations reached high densities, but overgrazing by wildlife and domestic livestock during the drought left the winter range in a deteriorated condition. This condition led to a rapid decline of wildlife numbers which continued into the 1940's. Scientific game management to provide maximum game populations consistent with habitat was initiated in the 1940's by state and federal management agencies. This program was aimed at preservation of critical habitat and management of population numbers.

The 1930's and 1940's saw a dramatic increase in mechanization in agriculture, mining, and forestry. Mechanization, combined with other industrial expansion, had adverse effects on the environment, resulting in increased erosion, sedimentation, pollution, and damage to open and green space.

At present, the basin reflects the accumulation of effects of land use changes on the environment. More environmental concern has led to land use regulations, mine reclamation laws, improved timber harvest techniques, and additional reserved areas such as wilderness and primitive areas. On September 17, 1974, Glacier National Park was designated as a World Biosphere Reserve.

The high quality of the present environment is partly indicated by the large portion of the land and river areas which are now or could be legally reserved for environmental quality. Table IV-17 shows that about 15 percent of the basin is already in wilderness, wild and scenic rivers, national park, or other reserved areas. Another 16 percent of the basin has potential for similar classification as reserved areas. Present policies restrict logging and certain other activities on federal lands now identified as having potential for reservation clarification.

TABLE IV-17--EXISTING AND POTENTIAL LAND AND RIVER RESERVATIONS
CLARK FORK OF THE COLUMBIA RIVER BASIN

Designated Area	Date	Acres
Wilderness Areas		
Bob Marshall	1940	709,360
Anaconda-Pintlar	1962	85,980
Selway-Bitterroot	1963	254,480
Cabinet Mountains	1964	39,540
Scapegoat	1972	155,530
Mission Mountains	1975	73,880
		1,318,770
Proposed Wilderness		
Glacier National Park		655,700
Wilderness Study Areas		
Hoodoo		75,480
Flint Range		35,270
Middle Fork Continental Divide		302,700
Swan Bunker		60,000
Tuchuck		18,360
Thompson Seton		18,500
Scotchman Peak		16,580
Silver King Falls Creek		9,700
Grizzly Basin		5,500
West Side Swan Monture		102,990
Arrasta Stonewall		9,400
		654,480
Primitive Areas		
Existing		-0-
Montana Wilderness Study Areas [1/]		
Sapphire		94,230
Blue Joint		61,540
		155,770
Citizens Interest Areas [2/]		
Sheephead		10,000
Burnt Fork, Wyman, Eagle Stoney		60,000
Cataract		16,700
Galena Creek		7,400
Canyon Peak		3,200
Trout Creek		23,040
Little Blackfoot, Cottonwood		20,000
		140,340

TABLE IV-17--EXISTING AND POTENTIAL LAND AND RIVER RESERVATIONS (Continued)

Designated Area	
	Acres
Other Identified Roadless Areas	1,600,000
Fish and Wildlife Service Lands	27,220
	Miles
Wild and Scenic Rivers	
South Fork of the Flathead	60.1
Middle Fork of the Flathead	100.6
North Fork of the Flathead	58.3
	219.0

Source: River Basin Planning Staff

1/ Montana S. B. 393-1975
2/ Identified by Montana Wilderness Association

The Montana Department of Fish and Game began buying and leasing wildlife winter range in 1948. Since then they have purchased approximately 24,900 acres and leased approximately 43,800 acres.

The variety of wildlife species is also an indicator of environmental quality. Wildlife species have specific habitat requirements that range from alpine-rockland and wet marshland to cropland. The animals may not range through the entire habitat areas mapped. Maps IV-1 through IV-9 present wildlife habitat information on the following species.

SPECIES	MAP
Elk	IV-1
Deer	IV-2
Moose	IV-3
Sheep	IV-3
Goat	IV-3
Bear	IV-4
Grouse	IV-5, IV-6
Pheasant	IV-7
Partridge	IV-8
Ptarmigan	IV-9
Turkey	IV-9

Pronghorn Antelope--Pronghorn antelope require prairie habitat, which is minimal in the basin, and only two small herds are present. Their habitat was not mapped.

Mountain Lion--Rough, timbered terrain is characteristic mountain lion habitat and a good population of prey animals is required for its survival. Mountain lions usually do not conflict with the land uses of man.

Mountain Caribou--The mountain caribou is considered a peripheral animal in the basin and inhabits only the northern portion of the study area during extreme winters when they are forced south from Canada.

Furbearers and Predators--Animals common in the basin which are classified as furbearers by the Revised Code of Montana, Section 26-201, 1975, include marten, bobcat, otter, muskrat, fisher, mink, and beaver. Predators include coyote, civet cat, weasel, and skunk.

Waterfowl--A wide variety of waterfowl inhabits the basin during the summer and a few ducks and geese winter along open rivers. Their habitat includes wetlands, glacial potholes, and riparian lands along streams and lakeshores.

Many acres of wetland habitat have been drained in the basin since the advent of agriculture, but in recent time, portions of this loss have been offset by federal and state acquisition and construction programs. Some wetland areas are still being converted to other uses. Loss of wetland areas affects waterfowl production, but other forms of wildlife such as amphibians suffer considerably more by these losses due to their relative nonmobility.

Type III and Type IV wetlands are important waterfowl habitat. Types I and II wetlands contiguous with Types III and IV are more important for waterfowl nesting areas than when occurring in isolated areas.

Nongame Wildlife--Many forms of nongame wildlife are present in the basin and most are affected to some extent by land-use patterns and human activity. Many nongame species are excellent indicators of the environmental situation. For example, the mourning dove, which is an indicator of good environmental quality, is decreasing.

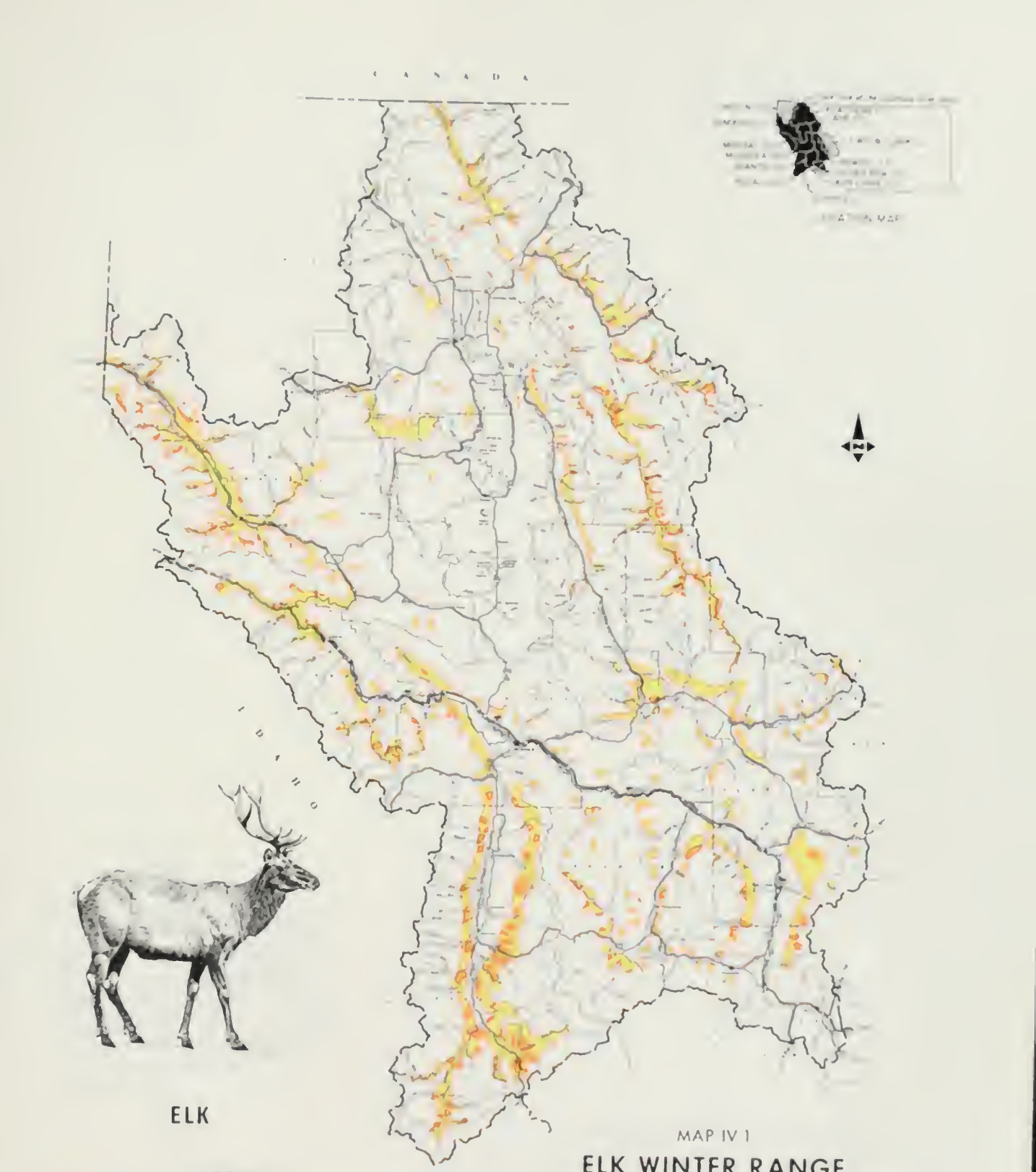
Threatened and endangered species are a prime indicator of man's influence upon the environmental quality of an area. Two endangered species--the American Peregrine falcon and the Northern Rocky Mountain wolf--have been documented as being observed in the basin. The grizzly bear, which is currently listed as a threatened species, occupies large portions of the more remote areas.

WATER AND RELATED ENVIRONMENT

Presently, the water quality of the basin is generally high and is better than in recent decades. Dewatering of streams for agricultural irrigation and pollution of receiving waters from irrigation return flows have somewhat diminished due to increased sprinkler irrigation. However, erosion and sediment production on forested, agricultural, and other lands reduce water quality and water habitat for fish reproduction. According to the Montana Department of Health and Environmental Sciences, several communities in the Clark Fork basin have, or are constructing, sewage facilities capable of meeting secondary sewage treatment standards.

Kalispell, Bigfork, Columbia Falls, Lolo, Galen, and the University of Montana Biological Station at Yellow Bay presently have secondary treatment facilities. Missoula, Butte, Alberton, Stevensville, and Superior are nearing completion of secondary facilities. Some of these communities have problems with plant operations or the systems in general which prevent their sewage treatment from consistently meeting state and federal secondary treatment standards. The City of Anaconda discharges wastes to the settling ponds of the smelter and treatment is considered adequate.

State law requires compliance with secondary standards "as soon as possible", while federal law requires all communities to comply by July 1, 1977. Other communities working toward compliance with these standards



ELK

LEGEND

Normal Winter

Severe Winter

Note: Mapped areas are general. Specific site information should be obtained from local offices of the Montana Department of Fish and Game.

MAP IV 1

ELK WINTER RANGE

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

Source
Base map prepared by SCS, Portland Carto. Unit from AMS 1 250,000 series.
Thematic detail prepared by State Staff.

U.S. DEPARTMENT OF AGRICULTURE

MT-PL-23425-10

DEER

MAP IV 2

DEER WINTER RANGE

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

LEGEND

Mule Deer — White-tailed Deer

Note: Mapped areas are general. Specific site information should be obtained from local offices of the Montana Department of Fish and Game.

Source
Base map prepared by SCS, Portland Corto. Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.

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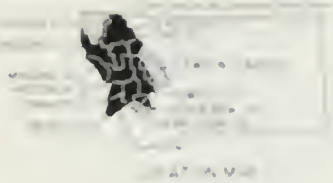
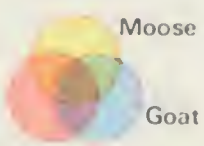
GOAT

MOOSE

SHEEP



LEGEND



Note: TOTAL RANGE This includes major known normal annual use area, but does not include all peripheral range. Specific site information is available from the Montana Department of Fish and Game

MAP IV-3

MOOSE, SHEEP, AND GOAT RANGE

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MAY 1976

Base map prepared by [illegible], Portland Cartographic from AMS 1:[illegible] series
Thematic detail prepared by State staff

U.S. DEPARTMENT OF AGRICULTURE

BEAR

MAP IV 4

BEAR RANGE

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

LEGEND

Bear

Note: Includes all use areas for black and grizzly bear. Specific site information is available from the Montana Department of Fish and Game.

U.S. DEPARTMENT OF A[illegible]RE

M7-PL-2342[illegible]-13

RUFFED GROUSE

MAP IV 5

UPLAND GAME HABITAT

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

LEGEND

Ruffed Grouse

Note: Based on vegetation patterns.

0 0 10 20 30 40 MILES

Source
Base map prepared by SCS, Portland Cartographic Unit from AMS 1:250,000 series.
Thematic data prepared by State Staff.

U.S. DEPARTMENT OF AGRICULTURE

BLUE GROUSE

MAP IV 6

UPLAND GAME HABITAT

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

LEGEND

Blue Grouse and/or Spruce Grouse

Note: Based on vegetation patterns.

Base map prepared by [illegible], Portland, Oregon. Unit from AMS 1:250,000 series.
Thematic data prepared by State staff.

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PHEASANT

MAP IV 7

UPLAND GAME HABITAT

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 30 40 MILES

LEGEND

Ring-necked Pheasant

Note: Based on vegetation patterns.

Source
Base map prepared by SCS, Portland Cartographic Unit from AMS 1:250,000 series.
Thematic data prepared by State Staff.

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HUNGARIAN PARTRIDGE

MAP IV 8

UPLAND GAME HABITAT

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

LEGEND

Hungarian Partridge(Gray Partridge)

Note: Based on vegetation patterns.

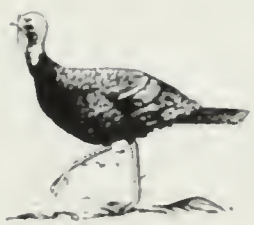
10 0 10 20 30 40 MILES

SCALE 1 : [illegible]

Source:
Base map prepared by SCS, Portland Carto. Unit from AMS 1:250,000 series.
Thematic data prepared by State Staff.

U.S. DEPARTMENT OF AGRICULTURE [illegible]

MT. PL. [illegible]



TURKEY

PTARMIGAN

MAP IV 9

UPLAND GAME HABITAT

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

LEGEND

White-tailed Ptarmigan

Merriam's Turkey

Note. Based on vegetation patterns

Base map prepared by [illegible], Portland, Oregon, from AMS 1:250,000 series.
Thematic detail prepared by State staff.

include Darby, Deer Lodge, Drummond, Hamilton, Hot Springs, Charlo, St. Ignatius, Ronan, Thompson Falls, Whitefish, and Warm Springs State Hospital.

Industries in the basin working toward compliance with the 1977 standards include Hoerner-Waldorf Co. in Missoula, Anaconda Co. at Butte and Warm Springs, and Consolidated Dairies at Ronan. Pollution of water is being abated at the present time.

Fish

Fish species are excellent indicators of water quality. For example, the occurrence and distribution of the native westslope cutthroat trout has decreased markedly within the last 50 years. Portions of its former habitat are now occupied with introduced species such as brook trout, rainbow trout, and brown trout. Fish and wildlife have been recognized as beneficial users of water under the 1973 Montana water use acts.

Fisheries resources of the basin are quite diverse and range from high mountain lakes and streams to lowland reservoirs and rivers. Both cold and warm water fish are found in the area.

There are over 700 ponds, lakes, and reservoirs identified in the study area with a population of game fish present. These ponds, lakes, and reservoirs cover about 231,000 acres. Over 20 species of fish occur in these bodies of water.

The basin contains about 98 miles of class 1 blue ribbon streams, 411 miles of class 2 streams, 833 miles of class 3 streams, and 1,074 miles of class 4 streams. (See map IV-10.) There are several thousand miles of streams with game fish populations present which have not been classified under the present fisheries class system. Reservoirs have inundated about 102 miles of previously free-flowing streams in the basin. The largest reservoirs constructed in the last 40 years were Kerr Dam and Hungry Horse Dam.

PROJECTIONS

A large number of forces influence economic activity and long-term economic growth. None of these forces can be considered as fixed. Furthermore, these forces vary in their relative influence over time. Changing incomes, shifting tastes, development of substitute products, and changing prices tend to modify trends. Substitute products cause changes in use patterns. The expansion of world markets affects the agricultural industry of the United States and its various regions.

Two sets of agricultural projections are analyzed in this study: OBERS series C and Modified OBERS series C. Some comparisons are also made with OBERS series E projections since this set is now being used in river basin studies; however, series E is not an alternative projection in the Clark Fork study. These projections are not predictions of future levels of production but, rather, they are approximations of what may occur if a specific set of assumptions are, in fact, to happen.

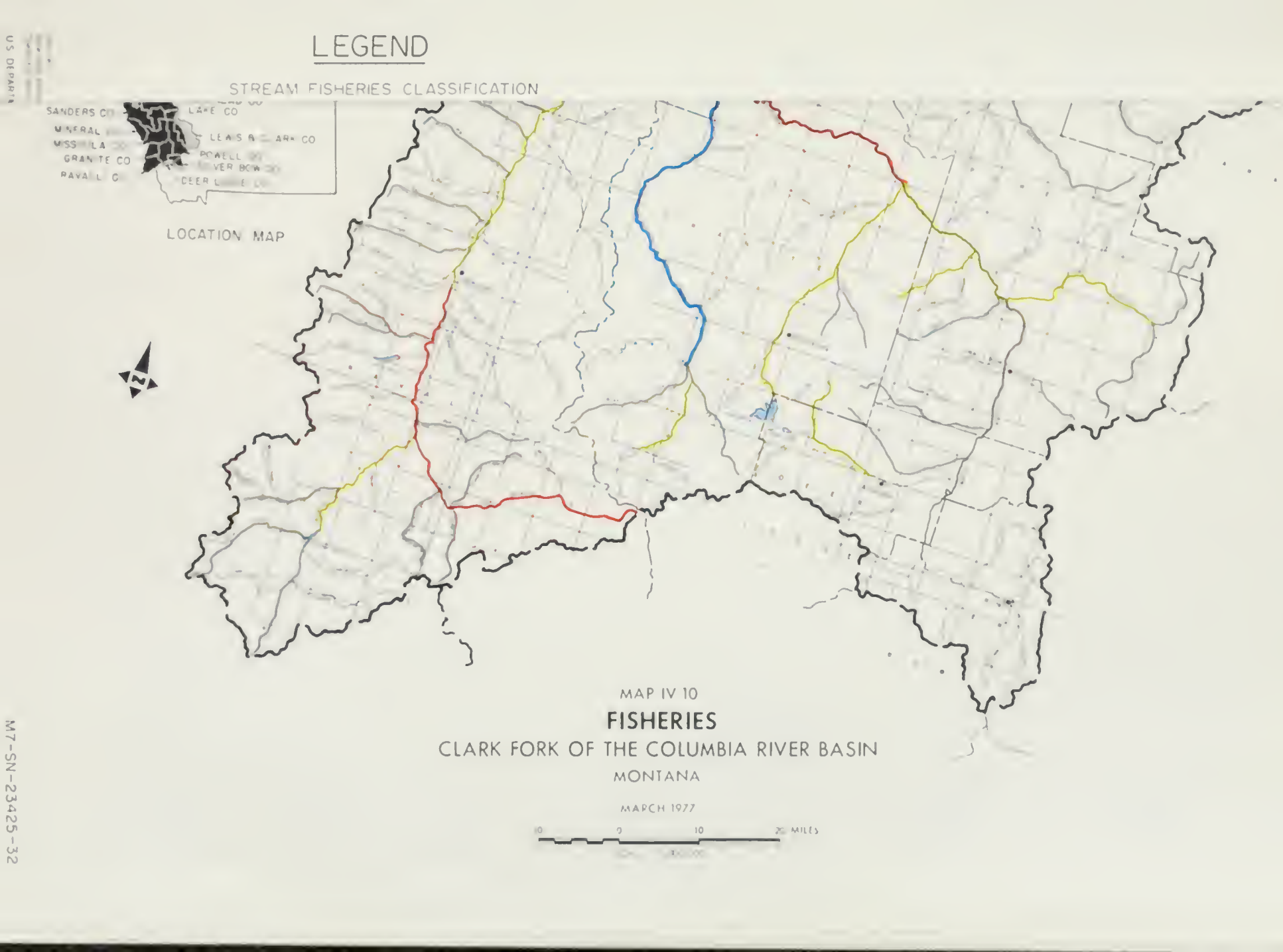
GENERAL METHODOLOGY

The OBERS series C projections were selected as a baseline projection for the study area. 1/ The baseline concept, in simplest terms, means that a particular set of projections is selected as a base against which other projections are compared or analyzed as alternatives. They should not, however, be viewed as quotas that must be met in the case of projections of food and fiber.

The 1972 OBERS projections contain estimates for 20 major water resource regions and 205 subareas which have been designated, in addition to estimates by states. Water Resources Subarea (WRSA) 1702 conforms to the study area if two counties, one in Idaho and one in Washington, are excluded. The Montana portion of WRSA 1702 is the Clark Fork study area. This study area, for purposes of analysis and presentation of data, was further disaggregated into three smaller subareas, as delineated in other sections of this report.

The OBERS population projection Series C was adjusted for use in the Clark Fork study area and its subareas. The Clark Fork study area has experienced a more rapid rate of population growth than has Bonner and Pend O'Reille Counties, two counties not in the Clark Fork study area or in Montana, but included in WRSA 1702. A trend line was calculated for each economic subarea, based upon the decennial census years 1930-1970. The trend line was extrapolated throughout the projection period 1990-2020.

1/ The term OBERS was adopted to represent a joint effort by the former Office of Business Economics, U. S. Department of Commerce, and the Economic Research Service of the U. S. Department of Agriculture. Although OBE has become the BEA (Bureau of Economic Analysis), the OBERS designation has been continued.



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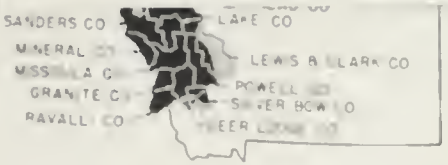
LEGEND

STREAM FISHERIES CLASSIFICATION



LOCATION MAP

MAP IV-10

FISHERIES

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

0 10 20 MILES

Source:
Base map prepared by SCS, Portland Cartog. Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.

U.S. DEPARTMENT OF AGRICULTURE

M7-SN-23425-32

The employment projections were formulated by extending the employment to population ratios from the historic base into the future. Usually growth in population due to in-migration is a function of employment opportunities, except in a few areas which attract an especially large number of retired persons and recreational home sites. The Flathead subarea seems, in some degree, to characterize the latter type of growth.

The methodology for projecting personal income was similar to that for population and employment.

Projections for food and fiber were estimated for the Montana portion of WRSA 1702, which conforms to the Clark Fork study area. For a projection of requirements or demand, there is no attempt to provide a disaggregation to the subareas.

OBERS ECONOMIC PROJECTIONS

General Assumptions

The general assumptions that underlie the OBERS Series C projections are as follows:

-- Growth of population will be conditioned by a decline of fertility rates from those of the 1962-1965 period.

-- Nationally, reasonably full employment, represented by a four-percent unemployment rate, will prevail at the points for which projections are made; as in the past, unemployment will be disproportionately distributed regionally, but the extent of disproportionality will diminish.

-- No foreign conflicts are assumed to occur at the projection dates.

-- Continued technological progress and capital accumulations will support a growth in private output per man-hour of three percent annually.

-- The new products that will appear will be accommodated within the existing industrial classification system.

-- Growth in output can be achieved without ecological disaster, although diversion of resources for pollution control will cause changes in the industrial mix of output.

The study area projections are based on the following additional assumptions:

-- Most factors that have influenced historical shifts in regional "export" industry location will continue into the future with varying degrees of intensity.

-- Trends toward economic area self-sufficiency in local service industries will continue.

-- Workers will migrate to areas of economic opportunities and away from slow-growth or declining areas.

-- Subarea earnings per worker and income per capita will continue to converge toward the national average.

-- Subarea employment/population ratios will tend to move toward the national ratio.

OBERS Projected Population

The OBERS projections of population are based upon the Series C projections issued by the Census Bureau in 1970. The fertility rate per 1,000 women in that series is projected to be a substantial decline from the 1962-1965 level. In spite of the declining fertility rate, series C projections call for an approximate doubling of the national population between 1968 and the year 2020.

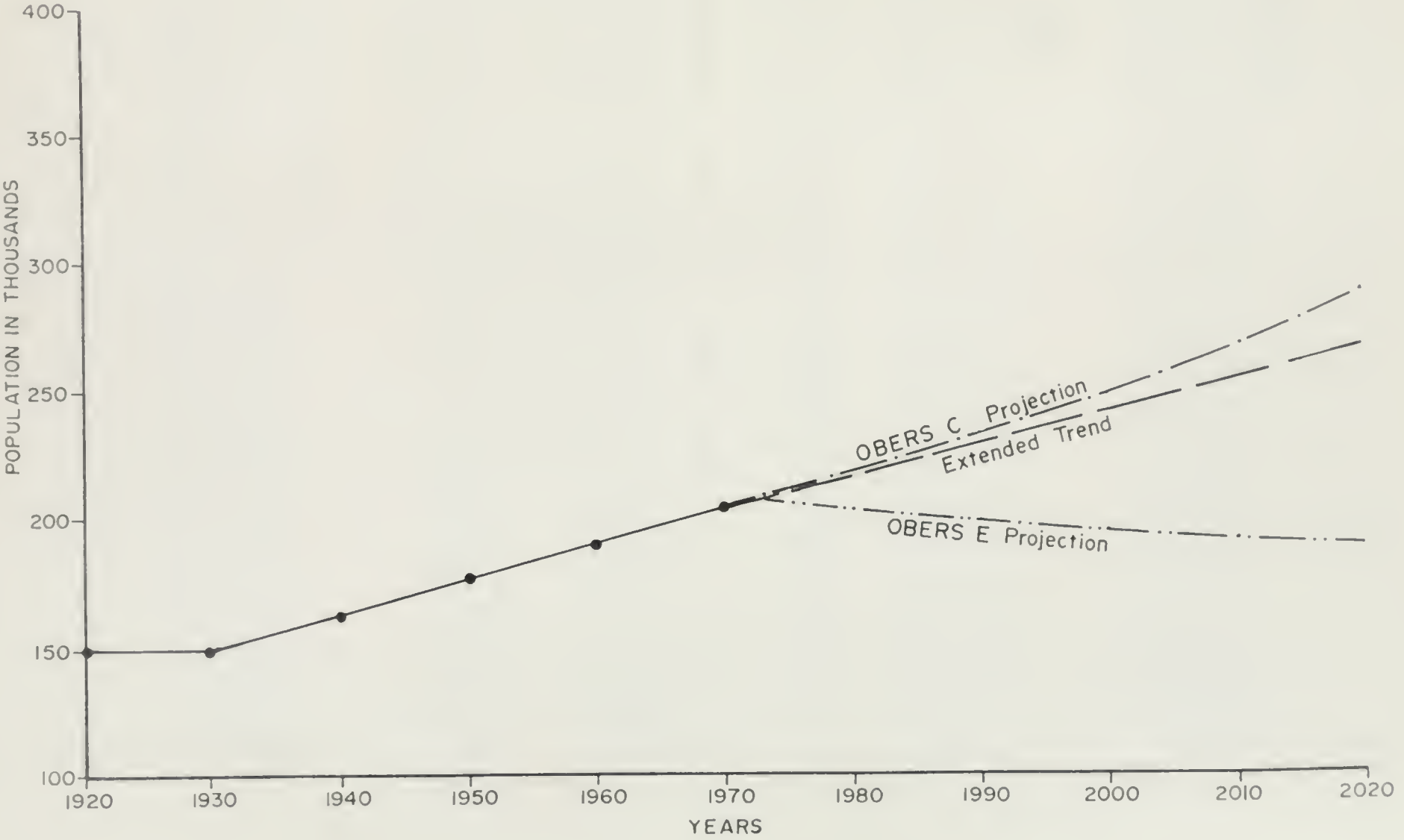
The population of the Clark Fork study area is projected to increase from 203,618 in 1970 to 284,465 in 2020 (table IV-18). This represents an increase of 40 percent over the 50-year period.

Recent population estimates seem to confirm the choice made earlier in the study to use the OBERS series C projections rather than the lower OBERS series E projections. See figure IV-2.

Populations for series C and series E for the United States and for Water Resource Subarea 1702 (WRSA 1702--basically, the Clark Fork area) are:

	United States		WRSA 1702	
	C	E	C	E
	(000)		(000)	
1969	201,877	201,298	224.2	223.8
1980	234,208	223,532	240.3	222.3
2000	306,782	263,830	271.7	212.5
2020	399,013	297,146	313.6	209.5

FIGURE IV-2--POPULATION IN THE CLARK FORK OF THE COLUMBIA RIVER BASIN, 1920-2020



Projected Employment

The long-term employment trends for the study area have an important bearing on the projected economic growth of a region or area. Employment projections for the study area are presented in table IV-19. Employment in the study area is projected to increase from 69,000 in 1970 to 106,000 in the year 2020--an average annual growth rate of about nine-tenths of one percent.

Projected Income

Projections of income indicate, to some degree, the study area's potential as a consumer market and somewhat of a measure of the ability of an area to support public service expenditures. The OBERS projections of personal income are stated in 1967 dollars. The 1970 data for the study area were adjusted to 1967 dollars to provide the base from which the extensions were made.

Personal income for the Clark Fork study area is projected to increase from approximately $544.8 million in 1970 to $3.7 billion in 2020, as measured in constant 1967 dollars (table IV-20).

Projected Demand for Food and Fiber--OBERS Series C

For the Clark Fork study area, small grains production is projected to continue its relative importance (table IV-21). Wheat and barley production will increase significantly throughout the projection period. The OBERS C projection, based on historic shares of national production, indicates an increase in sugar beet production for the study area. Actually, the future of this crop is very uncertain in the Clark Fork.

Hay crops for an expanding livestock industry are projected to increase 123 percent in production through the projection period. Red meat production is projected to increase over 150 percent. Lamb and wool production attains a modest increase of 13 percent. Production of dairy products in the study area is projected to decline.

Outdoor Recreation Projections

Outdoor recreation activity occasions are projected to increase from 14.9 million to 21.9 million by 1990 and to 36.2 million by the year 2020 for the 16 activities (table IV-22). These projections were made by the Recreation Data Subcommittee of the Pacific Northwest River Basin Commission and are based on OBERS Series C population projections and rates of growth in per capita participation, differing for each kind of activity.

TABLE IV-18--PROJECTED POPULATION GROWTH, BY SUBAREA, WITH COMPARISONS 1970, 1990, 2000, and 2020

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	1970	1990	2000	2020
	- - - - - - - number - - - - - - - - -			
Flathead	54,000	66,000	70,000	81,000
Lower Clark Fork	83,000	105,000	116,000	151,000
Upper Clark Fork	67,000	61,000	60,000	52,000
Total Clark Fork Study Area	204,000	232,000	246,000	284,000
Total WRSA 1702	225,000	256,000	272,000	314,000
Montana	694,000	755,000	790,000	902,000

Based on OBERS Series C population projections.

TABLE IV-19--TOTAL AND BASIC EMPLOYMENT, BY SUBAREA, WITH COMPARISONS 1970 AND PROJECTED 1990, 2000, AND 2020

Item	1970	1990	2000	2020
	- - - - - - - number - - - - - - - - -			
Flathead				
Total	17,000	21,000	22,000	27,000
Basic[1/]	7,100	8,700	9,100	11,200
Lower Clark Fork				
Total	29,000	39,000	44,000	60,000
Basic[1/]	12,600	16,900	19,000	26,000
Upper Clark Fork				
Total	23,000	22,000	21,000	19,000
Basic[1/]	11,200	10,700	10,200	9,300
Clark Fork Study Area				
Total	69,000	82,000	87,000	106,000
Basic[1/]	30,900	36,300	38,300	46,500

Based on OBERS Series C population projections.

1/ Basic employment is that which brings outside money into the study area. To maintain a viable economy, enough outside money must be brought into the area to pay for goods and services brought from outside the area.

TABLE IV-20--PERSONAL INCOME, TOTAL AND PER CAPITA, BY SUBAREA
1970 AND PROJECTED 1990, 2000, AND 2020
(1967 CONSTANT DOLLARS)

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	1970		1990		2000		2020	
	Per Capita	Total	Per Capita	Total	Per Capita	Total	Per Capita	Total
	dollars	1,000 dollars	dollars	1,000 dollars	dollars	1,000 dollars	dollars	1,000 dollars
Flathead Subarea	2,637	142,147	[illegible],594	370,522	7,136	499,520	12,930	1,047,330
Lower Clark Fork	2,639	218,306	5,599	587,895	7,142	828,472	12,841	1,494,041
Upper Clark Fork	2,752	184,356	5,838	356,118	7,447	446,820	13,493	761,636
Total Clark Fork Study Area	2,676	544,809	5,666	1,314,535	7,214	1,774,812	13,040	3,703,057

Based on OBERS Series C projections.

TABLE IV-21--PROJECTED DEMAND FOR AGRICULTURAL COMMODITIES, CURRENT NORMAL AND OBERS C PROJECTIONS
1990, 2000, AND 2020

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Unit	Current Normal	1990	2000	2020
		- - - - - - - - - - - - thousands - - - - - - - - - - - -			
Wheat	bu.	1,965.5	2,963.1	3,206.9	3,601.0
Rye	bu.	1.5	3.8	3.6	3.2
Corn for silage	tons	18.2	45.1	53.8	72.4
Oats	bu.	488.3	1,520.1	1,687.4	1,931.3
Barley	bu.	2,248.7	3,186.4	3,737.0	4,674.3
Fruit--non-citrus	tons	4.9	0.5	0.2	0.2
Vegetables	cwt.	22.8	10.9	7.8	3.4
Sugar beets	tons	12.6	53.8	66.1	96.9
Irish potatoes	cwt.	1,011.8	683.5	689.9	690.8
Hay crops	tons	672.8	821.2	934.6	1,543.5
Beef and veal	lbs (lwt.)	108,370.7	179,072.2	206,217.3	279,828.4
Pork	lbs (lwt.)	10,054.8	14,487.1	16,657.1	21,977.4
Lamb and mutton	lbs (lwt.)	1,432.3	1,539.7	1,558.5	1,632.4
Replacement chickens	lbs (lwt.)	1,070.3	745.2	583.5	372.9
Eggs	number	50,000.0	47,500.4	46,000.0	42,000.5
Milk	pounds	83,160.0	78,500.8	67,000.0	50,000.0

Current normal data from Montana Agricultural Statistics, 1968, 1969, 1970, and U. S. Census of Agriculture, 1969. Projections from unpublished material supporting the agricultural portion of the Water Resources Council OBERS projections, series C.

TABLE IV-22--OUTDOOR RECREATION PROJECTIONS

CLARK FORK OF THE COLUMBIA RIVER BASIN

Activity	1970 [1/]	1990	2020
	Thousands of Activity Occasions		
Camping	1,682	2,551	4,217
Picnicking	724	1,187	1,928
Swimming	272	481	925
Sightseeing and driving for pleasure	5,040	7,360	12,169
Fishing	642	731	914
Boating	249	443	843
Water skiing	97	185	376
Walking and hiking	1,501	2,117	3,191
Hunting	377	430	557
Playing outdoor games	477	816	1,517
Bicycling	408	724	1,382
Golfing	80	149	292
Horseback riding	164	231	363
Attending outdoor sporting and/or culture events	1,535	1,909	3,213
Snow activities	524	938	1,833
Other	1,096	1,618	2,455
Total	14,868	21,870	36,175

Source: Recreation Committee, Pacific Northwest River Basin Commission

1/ Many of these activities were tabulated on weekend use only.

One of the outstanding trends in nonurban areas is the pronounced shift to dispersed recreation activities. While existing facilities continue to be used, especially those associated with water-oriented activities, the recreationist is expanding his horizon and now roams far and wide in search of new opportunity. The key to this new phenomenon is the mobility and self-sufficiency of the user. A mobile and self-sufficient recreationist is a discriminating user who will go to the place that provides the type of recreation and quality of environment desired on a given day. For the four National Forests constituting the bulk of the forest land, the annual budget for adequate maintenance of the recreation program is projected to increase

from the current $1,080,000 to $1,740,000 in 1990 and $2,550,000 in 2020. The backlog on construction is $1,904,000, including facilities for 200 camper stalls at critically overused sites. If the trend continues, new types of services will be needed and some traditional services will have to be deemphasized.

Forest Products Projections

The national demand projections, disaggregated to this river basin, indicate a 24 percent increase in industrial roundwood by 1990 and a 60 percent increase by 2020 over the annual harvest volume of 1970. Most of the projected demand is for saw and veneer logs (large-diameter trees). Demand for pulpwood will also increase from 0.7 million cubic feet in 1970 to 5.9 million cubic feet in 1990 and to 16.6 million cubic feet in 2020. The demand for other roundwood, such as posts and poles, will remain relatively constant (table IV-23).

TABLE IV-23--OBERS C PROJECTED ROUNDWOOD DEMAND

CLARK FORK OF THE COLUMBIA RIVER BASIN

Items	1970	1990	2020
	- - - million cubic feet - - -		
Roundwood Harvest			
Saw and veneer logs	119.1	143.0	175.4
Other roundwood	2.0	2.2	2.6
Pulpwood	0.7	5.9	16.6
All Roundwood	121.8	151.1	194.6

Source: River Basin Planning Staff. Based on OBERS C projections.

Aquaculture Projections

Projections of future aquaculture production have not been made, but it is assumed that demand will grow at least at the national population growth rate. Commercial fish production in the basin grew fourfold between 1974 and 1976 and larger growth is anticipated.

Electrical Power Projections

The Power Planning Committee of the Pacific Northwest River Basin Commission projected demands and supplies of electrical energy for the PNWRBC area through 1996. The western Montana share of those projected power needs is about 6.7 percent or 3,200 peak megawatts in 1990 as compared with 1,550 peak megawatts in 1976. Total electrical energy consumption in western Montana is projected at 18,100 million kilowatt hours in 1990 as compared with 8,920 mkwh in 1976. These figures may be conservative if there is massive conversion to electrical heating following Canada's expected moratorium on crude oil and natural gas export to the United States.

AGRICULTURAL LAND USE REQUIREMENTS

One method of estimating the best agricultural land use pattern is to use a linear program model. A linear program model consists of a mathematical objective function to be optimized (minimum cost or maximum profit) subject to a set of constraints. In this study a model was used to provide a least-cost pattern of land use to compare with the current land use pattern and for the various projections of crops and forage production in 1990, 2000, and 2020. The model also provides information on value, costs, and net returns from agricultural production from state and private land.

OBERS projections present no data on production from range, dry pasture, or grazed woodlands. Hence, the study team assumed this forage production would remain constant for this projection.

Early in the study there was an analysis to show that livestock products as projected in OBERS series C could be produced from the forage commodities projected if the range, grazed forests, and dry pasture continue to be available. The Clark Fork linear program model analyzed crop and forage production but did not include livestock as an output item.

The irrigated crop budget costs data available are for sprinkler irrigation methods. These cost data were the basis for all irrigated lands except mountain meadows. Irrigation costs were varied according to the estimated number of irrigations required each season to obtain the production levels in each subarea. Water and management costs were not included in the model. Net returns were considered as returns to these factors.

Table IV-24 shows the current normal and estimated least-cost land use requirements to produce the current normal and OBERS series C projected crop and forage commodities.

The least-cost linear program analysis allows crop production to shift between soil resource groups and between irrigated and dry cropland to a least-cost optimum cropping pattern. The analysis indicates that for the

AND 2020--WITH COMPARISON WITH CURRENT NORMAL BY SUBAREA

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Current Normal	Least-cost for Current Normal Prod.	1990	2000	2020
			acres		
UPPER CLARK FORK					
Irrigated cropland	121,678	51,428	54,767	58,393	111,955
Irrigated perm. pasture	28,640	28,640	28,640	28,640	28,640
Nonirrigated cropland	22,173	88,398	85,949	82,323	88,777
Subtotal	172,491	168,466	169,356	169,356	229,372
Other nonirrigated 1/	1,284,686	1,284,686	1,284,686	1,284,686	1,228,507
LOWER CLARK FORK					
Irrigated cropland	92,488	60,813	71,300	64,529	91,919
Irrigated perm. pasture	77,937	77,937	77,937	77,937	77,937
Nonirrigated cropland	60,184	90,195	80,193	80,306	121,540
Subtotal	230,609	228,945	229,430	222,772	291,396
Other nonirrigated 1/	1,304,696	1,304,696	1,304,696	1,304,696	1,247,125
FLATHEAD					
Irrigated cropland	77,234	43,705	62,224	60,299	74,201
Irrigated perm. pasture	54,713	54,713	54,713	54,713	54,713
Nonirrigated cropland	131,525	171,078	152,425	154,299	166,791
Subtotal	263,472	269,496	269,362	269,311	295,705
Other nonirrigated 1/	605,588	605,588	605,588	605,588	579,565
CLARK FORK STUDY AREA					
Irrigated cropland	291,400	155,946	188,291	183,221	278,075
Irrigated perm. pasture	161,290	161,290	161,290	161,290	161,290
Nonirrigated cropland	213,882	349,671	318,567	316,928	377,108
Subtotal	666,572	666,907	668,148	661,439	816,473
Other nonirrigated 1/	3,194,970	3,194,970	3,194,970	3,194,970	3,055,197

Source: Clark Fork study area linear programming model.
1/ Includes private and state dry pasture, range, and forest land grazed.

estimated total crop and forage production levels, the least-cost cropping pattern would be to reduce irrigated land area considerably and convert to dry cropland production of hay and other crops. Another way of expressing the results is that the present pattern of irrigation on many soils is highly uneconomic unless in reality the irrigation costs are considerably below the irrigation cost data available. This is especially true for the irrigated permanent pasture which now constitutes about 36 percent of the total irrigated land.

The least-cost results are not presented as a recommendation; rather, they point to one possible means of increasing production while minimizing certain costs. They do not consider some alternative means of increasing production, such as increased drainage. Other alternatives may be chosen, such as restricting production to the levels shown with ongoing programs. Or other goals and preferences may suggest increased production at higher alternative costs.

ALTERNATIVE ECONOMIC PROJECTIONS

GENERAL ASSUMPTIONS

The general natural assumptions underlying the OBERS series C projections are essentially adequate for this study. Likewise, the assumptions for study area projections are generally adequate. However, when the OBERS disaggregated commodity, employment, and earnings figures are closely examined, many inconsistencies appear which do not reflect historical trends and economics of the basin. The following discussion attempts to develop alternative figures for farm commodity items, irrigated areas, and reasons for the modification. No alternative projections were made for forest products, recreation, or aquaculture.

MODIFIED PROJECTED DEMAND FOR FOOD AND FIBER

The OBERS projections do not appear entirely realistic in their projections of demand for agricultural commodities for the basin. Oats will not increase significantly throughout the projection period because of climatic and economic limitations. Sugar beet production has nearly disappeared. Fruit and potato production will probably not decrease as projected by OBERS, but will more than likely stabilize. Milk production is not anticipated to drop further but to stabilize near current levels, though dairy cattle numbers will probably decrease.

In the OBERS series C projection, hay crops do not increase nearly as rapidly as beef and veal production through the year 2000. Beyond 2000, this projection shows hay production increasing much more rapidly than beef and veal production. In the alternative projection, hay production is

increased for the mid projection period to more nearly relate to the anticipated beef and veal production. See table IV-25 for modified projections of farm commodities.

The least-cost linear program described earlier was recomputed using the same basic assumptions but with the modified level of production for the alternative projection (table IV-26).

The modified OBERS projection with its combination of no increase in oats production and nearly straight line increase in hay production has resulted in the rather sharp increase in the requirement for irrigated lands by 1990, compared with least-cost current normal, and the subsequent decrease in requirement for 2000. Here again the projected requirements for irrigated are not as large as the current normal reported irrigated acreage.

PROJECTED ECONOMIC EFFECTS RELATED TO OBERS C AND MODIFIED OBERS PRODUCTION

Table IV-27 displays the costs and returns solution for the least-cost linear program for the OBERS series C and modified OBERS crops and forage projections. Commodity prices used for the current normal analysis were weighted average 1970 county prices for the 10 counties within the study area. Projected prices for 1990, 2000, and 2020 were Montana prices published in Agricultural Price Standards, U. S. Water Resources Council, October 1974.

Costs for the current normal period were also approximate 1970 costs. For the projection period 1990 through 2020, costs were updated to be comparable with prices used in the projected analyses.

The relative low net returns per acre in the current normal period reflects the high incidence of part-time farming in the study area. See table IV-2. The least-cost cropping pattern for the current normal of production would result in an increased net return of $3.9 million. Net returns from the modified cropping pattern projections are about $4 million greater than similar returns from OBERS series C cropping patterns (table IV-27).

The linear programming model analyses were limited to the agricultural sectors and dealt with direct impacts only. Impacts of projected agricultural and forestry production on the study area's economy were estimated by an input-output (I-O) analysis. Input-output analysis is most importantly concerned with the structure of an economy and with economic interdependence. Impact analyses with the I-O method permit a choice between focusing upon a single sector for a general multiplier analysis or a regional impact analysis in which the primary concern is the total changes--both direct and indirect--in an economy which results from a changed output or final demand in one or more of the sectors. The impact analyses undertaken in this study are of the

TABLE IV-25--AGRICULTURAL PRODUCTION, BY COMMODITY GROUPS, CURRENT NORMAL AND MODIFIED OBERS PROJECTIONS 1990, 2000, AND 2020

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Unit	Current Normal	Modified Projections		
			1990	2000	2020
		- - - - - - - - - - thousands - - - - - - - - -			
Wheat	bu.	1,965.5	2,963.1	3,706.9	3,601.0
Rye	bu.	1.5	3.8	3.6	3.2
Corn for silage	tons	18.2	45.1	53.8	72.4
Oats	bu.	488.3	490.0	490.0	490.0
Barley	bu.	2,248.7	3,186.4	3,737.0	4,674.3
Fruit--non-citrus	tons	4.9	5.0	5.0	5.0
Vegetables	cwt.	22.8	10.9	7.8	3.4
Sugar beets	tons	12.6	-0-	-0-	-0-
Irish potatoes	cwt.	1,011.8	1,012.0	1,012.0	1,012.0
Hay crops	tons	672.8	1,059.0	1,192.0	1,544.0
Beef and veal	lbs/lwt.	108,370.7	179,072.2	206,217.3	279,828.4
Pork	lbs/lwt.	10,054.8	14,487.1	16,657.1	21,977.4
Lamb and mutton	lbs/lwt.	1,432.3	1,539.7	1,558.5	1,632.4
Replacement chickens	lbs/lwt.	1,070.3	745.2	583.5	372.9
Eggs	number	50,000.0	47,500.4	46,000.0	42,000.5
Milk	pounds	83,160.0	83,160.0	83,160.0	83,160.0

Current normal data from Montana Agricultural Statistics, 1968, 1969, 1970, and U. S. Census of Agriculture, 1969. Projections from unpublished material supporting the agricultural portion of the Water Resources Council OBERS projections, Series C and adjusted for observed trends.

TABLE IV-26--ESTIMATED LEAST-COST LAND USE REQUIREMENTS FOR THE ADJUSTED USER PROJECTION OF U.S. PRODUCTION FOR 1990, 2000, AND 2020 WITH COMPARISON WITH CURRENT NORMAL BY SUBAREA CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Current Normal	Least-cost for Current Normal Prod.	1990	2000	2020
			acres		
UPPER CLARK FORK					
Irrigated cropland	121,682	51,428	100,959	98,178	111,955
Irrigated perm. pasture	28,640	28,640	28,640	28,640	28,640
Nonirrigated cropland	23,632	88,398	44,349	47,131	79,387
Subtotal	173,954	168,466	173,948	173,949	219,982
Other nonirrigated 1/	1,284,686	1,284,686	1,284,686	1,284,686	1,238,649
LOWER CLARK FORK					
Irrigated cropland	92,833	60,813	86,857	80,127	91,923
Irrigated perm. pasture	77,938	77,937	77,937	77,937	77,937
Nonirrigated cropland	65,546	90,195	70,714	77,448	113,625
Subtotal	236,317	228,945	235,508	235,512	283,485
Other nonirrigated 1/	1,304,696	1,304,696	1,304,696	1,304,696	1,256,725
FLATHEAD					
Irrigated cropland	76,824	43,705	72,860	68,296	74,203
Irrigated perm. pasture	54,713	54,713	54,713	54,713	54,713
Nonirrigated cropland	139,758	171,078	143,130	147,693	163,468
Subtotal	271,295	269,496	270,703	270,702	292,384
Other nonirrigated 1/	605,588	605,588	605,588	605,588	583,913
CLARK FORK STUDY AREA					
Irrigated cropland	291,339	155,946	260,676	246,601	278,081
Irrigated perm. pasture	161,291	161,290	161,290	161,290	161,290
Nonirrigated cropland	228,936	349,671	258,193	272,272	356,480
Subtotal	681,566	666,907	680,159	680,163	795,851
Other nonirrigated	3,194,970	3,194,970	3,194,970	3,194,970	3,07 ,2?7

Source: Clark Fork study area linear programming model.
1/ Includes private and state dry pasture, range, and forest land grazed.

TABLE IV-27--VALUE OF CROPS AND FORAGE, LEAST-COST OF PRODUCTION, AND NET RETURNS FOR OBERS SERIES C AND MODIFIED OBERS--1990, 2000, AND 2020 WITH COMPARISON WITH CURRENT NORMAL

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Current Normal 1/	Least-Cost for Current Normal Production 1/	OBERS SERIES C			MODIFIED OBERS		
			1990 1/	2000 1/	2020 1/	1990 1/	2000 1/	2020 1/
	- - - - - - - - - - - - - - - - - - (1,000 dollars) - - - - - - - - - - - - - - - - - -							
Clark Fork Study Area								
Value from cropland	29,883	29,883	48,305	55,051	74,842	59,038	65,380	80,007
Total cost	21,699	17,791	25,938	27,210	40,489	32,804	33,673	40,139
Net returns 2/	8,184	12,092	22,367	27,841	34,353	26,234	31,707	39,868
Value from noncropland 3/	2,719	2,719	4,915	4,915	4,544	4,915	4,915	4,600
Total cost	195	195	248	248	226	248	248	231
Net returns 2/	2,524	2,524	4,667	4,667	4,318	4,667	4,667	4,369

Source: Least-cost linear programming model for Clark Fork study area.

1/ WRC 1974 current normal prices

2/ Returns to water, land, and management.

3/ Includes private dry pasture, range, and forest land grazed.

latter type--regional impact analyses. A 27-sector input-output model was constructed for the Clark Fork study area and it was with this model that the work on direct and indirect impacts was undertaken.

The emphasis for the I-O analyses is the agricultural and the wood products sectors. The expansion or contraction of these sectors, as reflected in the different sets of projections, triggers similar indirect effects in other sectors of the economy. These effects have been quantified in relation to value of output, value added, employment and income. Table IV-28 shows direct and indirect impacts of the modified OBERS agricultural projections. Table IV-29 presents the analysis for the logging and logging contracting and lumber and wood products sectors.

WATER REQUIREMENTS

Present municipal and industrial water uses in the basin are estimated to be over 153,000 acre-feet per year. This could increase to as much as 214,000 acre-feet per year by 2020. However, conservation measures probably could be instituted to keep future requirements at or below the total present use. A detailed analysis of municipal and industrial water uses is outside the scope of this study.

The major consumptive use of water by man in the basin is and will be for irrigation. About 542,100 acre-feet of water would be required by crops for a full irrigation water supply for presently irrigated crops in the ten-county study area in an average year. This is in addition to the effective precipitation during the growing season and does not include delivery and associated losses that occur in an irrigation system. Table IV-30 lists crop water requirements by subarea for the present condition and for two projections of land use requirements.

OBERS E' AGRICULTURAL PROJECTIONS

A new set of agricultural projections was published in May 1975 and are referred to as OBERS series E'. The series E population projections published in 1974 were retained but adjustments were made in consumption per capita, exports, and yields. These E' projections for agricultural demand generally fall between series C and series E. Also, agricultural production in WRSA 1702 held about the same portion of the national production as used for the series C and E projections. Thus, projected production allocated to WRSA 1702 does not decline as does the projected population.

Series E' are accepted projections for river basins studies; however, these projections evolved several years after initiation of this river basin study, so series C has been used in most of the analysis for this report.

TABLE IV-28--DIRECT AND INDIRECT ECONOMIC IMPACTS OF CHANGES IN AGRICULTURAL OUTPUT AS PROJECTED IN THE ALTERNATIVE PROJECTION

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Value of Gross Output (1,000 $)	Value Added (1,000 $)
Base year, 1970, All Sectors	1,429,013	885,973

	Direct Change 1/ Value of Gross Output	Direct & Indirect Change 1/, Value of Gross Output	Value Added Change 1/
1990	(1,000 current $)	(1,000 current $)	(1,000 current $)
Beef & sheep production	37,044	37,044	11,009
Dairy	24	24	12
Grains	7,174	7,174	4,627
Field crops	24,177	24,177	17,478
Agricultural services	0	1,473	948
All other agriculture	2,714	2,714	1,805
All other sectors	0	19,091	13,932
Total	71,133	91,697	49,811
2000			
Beef & sheep production	47,105	47,107	14,000
Dairy	0	29	15
Grains	8,865	8,865	5,717
Field crops	28,828	28,828	20,839
Agricultural services	0	1,816	1,169
All other agriculture	3,242	3,242	2,157
All other sectors	0	23,294	16,996
Total	88,040	113,181	60,893
2020			
Beef & sheep production	74,400	74,402	22,111
Dairy	0	40	21
Grains	10,749	10,749	6,932
Field crops	41,256	41,256	23,824
Agricultural services	0	2,608	1,678
All other agriculture	4,564	4,564	3,036
All other sectors	0	33,445	24,399
Total	130,969	167,064	88,001

1/ 1970-1990 change

1/ 1970-2000 change

1/ 1970-2020 change

Source: Input-output model for Clark Fork study area.

TABLE IV-29--DIRECT AND INDIRECT ECONOMIC IMPACTS OF CHANGES IN OUTPUT OF LOGGING AND LOGGING CONTRACTING AND OTHER LUMBER AND WOOD PRODUCTS SECTORS AS PROJECTED IN OBERS SERIES C

CLARK FORK OF THE COLUMBIA RIVER BASIN

Item	Value of Gross Output (1,000 $)	Value Added (1,000 $)
Base year, 1970, All Sectors	1,429,013	885,973

	Direct Change[1/] Value of Gross Output	Direct & Indirect Change 1/, Value of Gross Output	Value Added Change[1/]
	(1,000 current $)	(1,000 current $)	(1,000 current $)
1990			
Logging and logging contracting	9,728	9,728	8,144
Other lumber & wood products	27,255	27,255	13,242
All other sectors	0	11,240	7,868
Total	36,983	48,223	29,254
1/ 1970-1990 change			
2000			
Logging & logging contracting	17,023	17,023	14,253
Other lumber & wood products	47,696	47,696	23,769
All other sectors	0	19,671	13,769
Total	64,719	84,390	51,196
1/ 1970-2000 change			
2020			
Logging and logging contracting	24,319	24,319	20,362
Other lumber and wood products	68,137	68,137	33,106
All other sectors	0	28,102	19,671
Total	92,456	120,558	73,139
1/ 1970-2020 change			

Source: Input-output model for Clark Fork study area.

TABLE IV-30--NET CROP IRRIGATION WATER USE ESTIMATED FOR TWO PROJECTIONS OF IRRIGATED LAND REQUIREMENTS--TEN-COUNTY AREA

CLARK FORK OF THE COLUMBIA RIVER BASIN

	Upper Clark Fork		Lower Clark Fork		Flathead		Ten-County Area	
	Irrigated acres	Water acre-feet	Irrigated acres	Water acre-feet	Irrigated acres	Water acre-feet	Irrigated acres	Water acre-feet
Current Irrigated Area	150,322	138,000	170,771	229,300	131,537	174,800	452,630	542,100
OBERS C Projected Irrigation								
1990	83,410	76,610	149,240	201,100	116,940	154,820	349,590	432,530
2020	140,600	129,140	169,860	228,890	128,910	170,660	439,370	528,690
Modified OBERS Projected Irrigation								
1990	129,600	119,030	164,790	220,600	127,570	168,890	421,960	509,980
2020	140,600	129,140	169,860	228,890	128,920	170,680	439,380	528,710

Source: River Basin Planning Staff

DESIRED FUTURE ECONOMIC CONDITIONS

The following second level specific components of the NED objectives relate to those presented in chapter III and express desires identified through public involvement meetings held throughout the basin.

(1) The desire is for "full employment." In order to maintain a stable viable economy, there must be a corresponding increase in basic employment to support an increase in population. Extractive basic employment in mining, agriculture, and forestry is declining and other sources of basic employment must be found to bring outside money into the basin. For "full employment", 36,300 basic full-time jobs (an increase of 5,400 over 1970) will be required by 1990, and 46,500 basic employment jobs will be required by 2020 to support derivative employment of 45,700 and 59,500 and populations of 232,000 and 284,000, respectively. See tables IV-18 and 19.

(2) The desire is to reduce flood damages on 71,000 acres.

(3) Improve efficiency and production on 97,000 acres of crop and pasture land now having high water table problems.

(4) Improve crop production and irrigation efficiency on about 208,000 acres now irrigated, requiring about 340,000 acre-feet of late-season water.

(5) Help 24 communities improve their water delivery systems and develop dependable water supplies.

(6) Phase out or reduce maintenance of relatively unused recreational facilities on public land and implement new management practices and construct 200 new camping stalls at overused sites and provide services at new locations that the public needs and will use.

(7) Provide all desired urban recreational facilities as quickly as local funds become available.

(8) Provide additional technical assistance for improvement of existing private recreational facilities.

(9) Acquire general recreation access to public lands at 39 additional locations and fishing access at 62 additional stream locations.

(10) Improve recreational boating dispersion by providing improved boating facilities on 11 fluctuating reservoirs and at 5 sites on major use white-water rivers.

(11) Improve production efficiency on 319,130 acres of currently irrigated cropland, 640,000 acres of range; and 1,984,000 acres of commercial forest.

(12) Protect about 84,000 acres of "other" land from erosion.

(13) Provide generation or importation of 18,100 million kilowatt hours of electricity needed by 1990 as compared with 8,920 million kwh used in 1976. 1/

(14) Stop unnecessary subdivision of 47,000 acres better agr cultural and forested land projected for subdivision by 1990.

DESIRED FUTURE ENVIRONMENTAL CONDITIONS

ASSUMPTIONS

The desired future environmental conditions for this area are very difficult to quantify and qualify due to numerous public opinions. Generally, the public indicated that it wanted improvement in the environmental quality as long as the maintenance of the quality does not become a hardship on individual economic gains.

In a basin abundant in natural resources, it is sometimes difficult to define land and water requirements in specific terms. The ultimate need is for responsible land use and water management to assure preservation or enhancement of the quality environment of the basin. Such things as water quality improvements, flood damage reduction, and improved land management would all greatly benefit the environment.

DESIRED ACHIEVEMENTS

(15)(16) Erosion and sediment control to protect both land and water resources. The public recognizes that certain amounts of erosion and sedimentation are a natural part of the environment and would be very costly to control, but it wishes to control the increased erosion and sedimentation caused by human activities. Many of these erosion sources are due to land use changes and can be controlled by proper management practices. Provide erosion and sedimentation control on 173,000 acres of cropland; 640,000 acres of rangeland; 84,000 acres of other lands; 62,000 acres of forest land; and 52 miles of streambank along the upper Blackfoot and Little Bitterroot Rivers. Within the national forest, stop erosion on 2,500 miles of eroding forest trails, roads, and gullies.

(17) Existing federal and state legislation has shown that there is a strong desire to stop the discharge of sewage and industrial wastes to water of the area. This legislation requires complete treatment of all waste discharges by 1983. Twenty-one communities need tertiary sewage treatment and 16 of these still need secondary treatment.

1/ Based on the basin's share of projected power requirements shown in Review of Power Planning in the Pacific Northwest, by the Power Planning Committee, Pacific Northwest River Basins Commission, March 1976.

(18) The 1972 water pollution control amendments express a public desire to eliminate pollution from agricultural land. Irrigation water control is desired on 319,130 acres to eliminate the addition of chemicals, nutrients, and increased water temperatures from agricultural land.

(19)(25) This practice is addressed to two specific components identified in chapter III. Reservoirs should be operated to eliminate seasonal exposure of drawdown areas on 11 reservoirs to improve natural beauty and enjoyment by maintaining additional water during the late summer and fall periods. Reservoir control at Hungry Horse is desired to minimize overly cold water temperatures and water release fluctuations.

(20) It is desirable to maintain 104,000 acres of riparian vegetation along lakeshores and streams. Loss of riparian vegetation is due mainly to residential and agricultural encroachment.

(21) Development of 39 additional access sites to public land is desired to spread access use so that no sites are overused to the extent that they detract from the natural beauty of the areas which they serve.

(22) This specific component is desired to minimize damage to open and green space and natural beauty in general. Land use control and management would cover items such as subdivision, timber harvest methods, and clean cultivation methods. It is estimated that these management controls would be needed on all lands in the basin.

(23) Free-flowing streams are preferable on 2,516 miles of class I through class IV streams from a natural beauty standpoint.

(24) Protect minimum streamflows on 2,516 miles of class I through class IV stream.

(26) This specific component deals with the problem as stated in chapter III of decreasing numbers of wildlife. The desired environmental future is to have maximum numbers of wildlife within the carrying capacity of the presently nondeveloped land. Protect about 1,350,000 acres of big game winter range near the forest fringe and 16,400 acres of upland habitat and about 138,000 acres of wetland habitat types I, II, III, and IV in and around the agricultural areas.

(27) It is desirable to provide spawning run fish passage around existing and future installations of diversions, bridges, and culverts.

(28) Stop subdivision of wildlife habitat.

Relationship to Economic Projections

The desired future environmental conditions of the basin have various relationships with the OBERS projections for the same area.

OBERS projected that the population of the basin will increase by 80,847 between 1970 and 2020. This increase in population will conflict somewhat with the desired future environmental conditions in that these additional persons will be competing for goods, services, and recreational areas from the decreasing resource base. However, improved management of the resources could allow increased use by many more persons without serious degradation. Any additional withdrawals of water for agricultural, municipal, and industrial purposes may have adverse effects upon streams, lakes, and their associated aquatic systems. Use of additional acreage for agricultural purposes will often conflict with critical habitat needed for wildlife.

V. RESOURCE BASE AND EXISTING PROGRAMS

This chapter presents an inventory of current conditions, existing natural resources, and programs under way which may modify the use of those resources. Current inventories present data on quantity and quality of resources, their potentials, and their limitations for solving the problems and satisfying the specific objective components that were identified in the study and presented in chapter III.

PRESENT RESOURCE BASE

LOCATION AND SIZE

The Clark Fork of the Columbia River Basin in Montana includes all of the area west of the continental divide except for the Kootenai River drainage (table V-1). The basin contains about 8.3 percent of the total area of the Columbia River drainage and provides about 8.8 percent of its average annual flow.

TABLE V-1--COUNTY AREAS
CLARK FORK OF THE COLUMBIA RIVER BASIN

County	Area in Basin	Area in the Economic Study Area	Percent of County in Basin	Percent of Basin in County
	- - acres - -			
Deer Lodge	267,780	474,240	56	1.9
Flathead	3,285,050	3,379,200	97	23.8
Granite	1,111,680	1,111,680	100	8.0
Lake 1/	1,059,200	1,059,200	100	7.7
Lewis & Clark 1/	453,620	0	20	3.3
Lincoln 1/	116,130	0	5	0.8
Mineral	782,720	782,720	100	5.7
Missoula	1,679,360	1,679,360	100	12.2
Powell	1,497,600	1,497,600	100	10.8
Ravalli	1,528,320	1,528,320	100	11.1
Sanders	1,804,160	1,804,160	100	13.0
Silver Bow	239,590	458,240	52	1.7
TOTAL	13,825,170	13,774,720	---	100.0

1/ These counties were not included in the basin ten-county area used for much of the analyses in this study.

CLIMATE

Precipitation

The basin climate varies from humid alpine with over 100 inches of annual precipitation on some peaks along the continental divide in Glacier National Park and in the Bitterroot Mountains to semiarid with less than ten inches of annual precipitation a few miles east of Anaconda. High mountain ranges tend to intercept precipitation, leaving "rain shadow" dry areas downwind of them. Thus, most of the basin is made up of relatively wet mountain tops and dry valleys. The Flathead subbasin has more of a Pacific coastal climate, while the Upper Clark Fork basin has more continental weather.

Temperatures

Temperatures around Flathead Lake are moderated by the large body of water. Average length of the frost-free season is 120 days at Flathead Lake compared with 70 days at Butte, 90 days at Deer Lodge, 54 days at Philipsburg, 36 days at Ovando, 34 days at Lincoln, 11 days at Sula, and 100 days at Missoula. Map V-1 shows the average frost-free season for the basin.

Growing Seasons

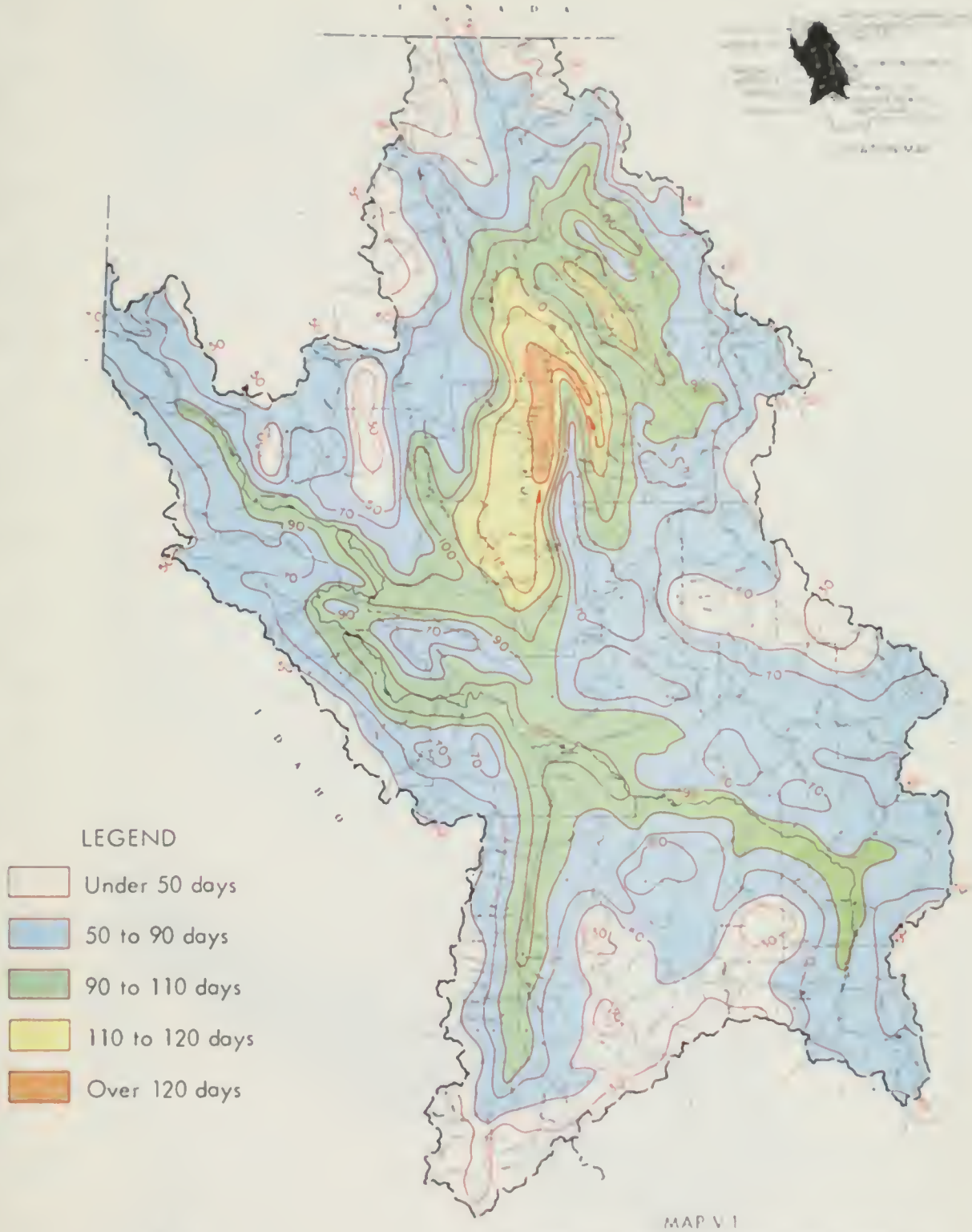
The short growing seasons and cool temperatures during the growing seasons, combined with soil and water limitations, effectively restrict the types of crops and yields that can be produced in the area. Seasonal temperature variations and averages for selected locations are shown in table V-2. In general, the temperatures are moderate for comfortable year-round habitation.

Precipitation and runoff yields are shown in maps V-2 and V-3, respectively. Effective precipitation data during the growing season for selected locations and crops are shown in table V-3. Precipitation and runoff determine the total water resource available for development. Effective rainfall is that which supplies some of the water needs of crops during the growing season.

LAND

Geology

The present Rocky Mountains in this region were formed during the latter Tertiary period, starting about 40 million years ago. The oldest rocks now exposed include gneisses, shists, argillites, and quartzites.



MAP V 1

AVERAGE FROSTFREE SEASON

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

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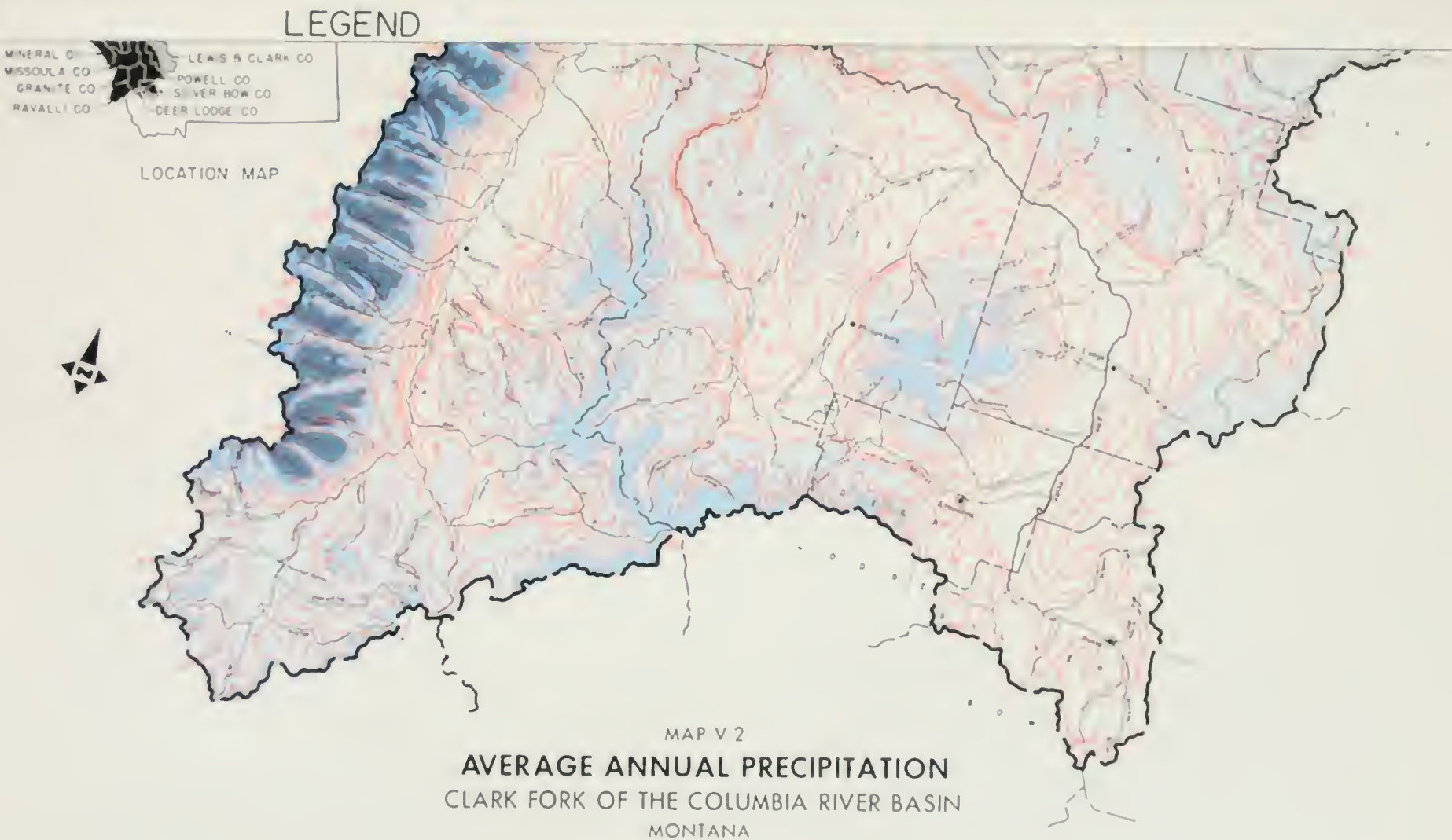
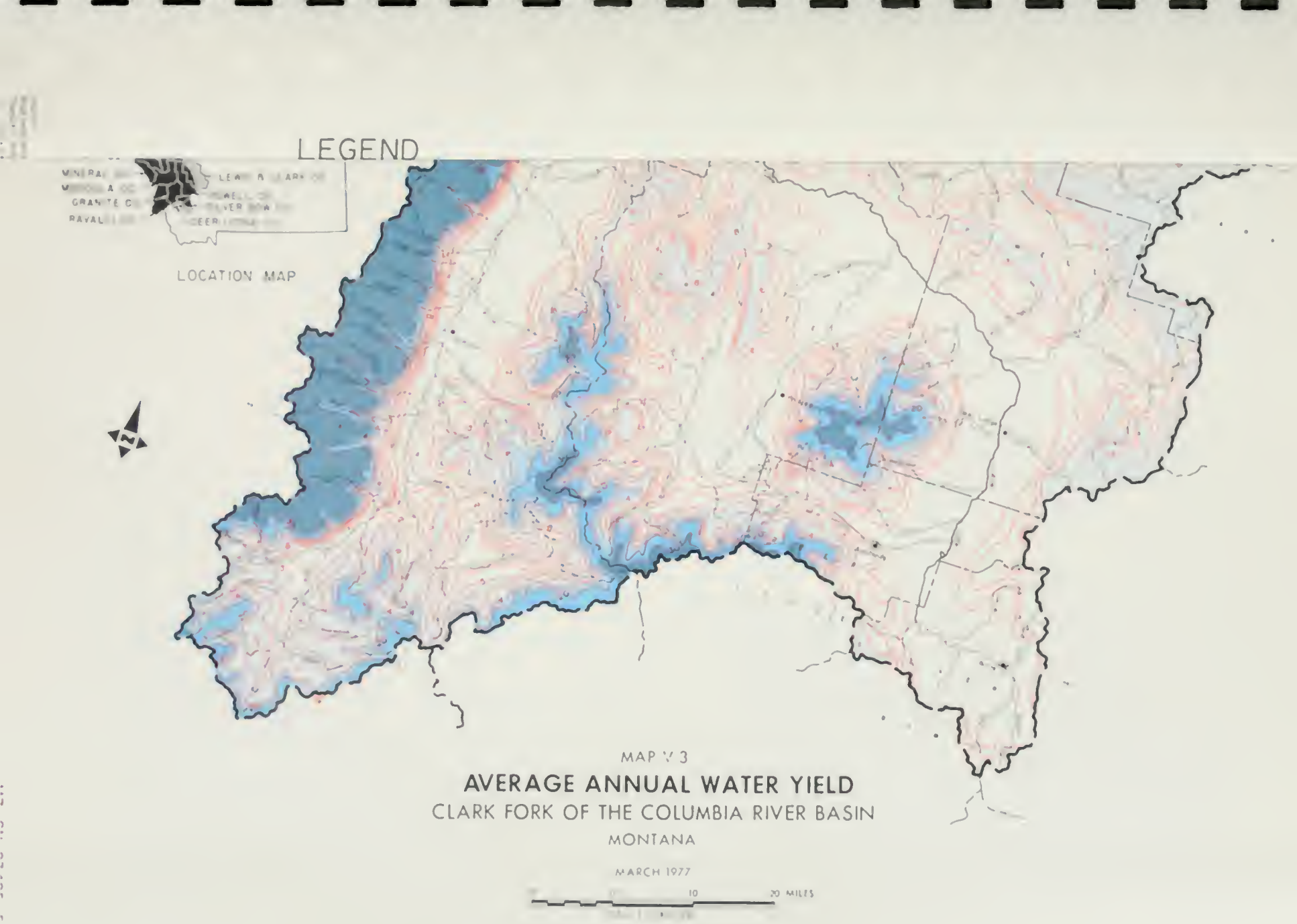
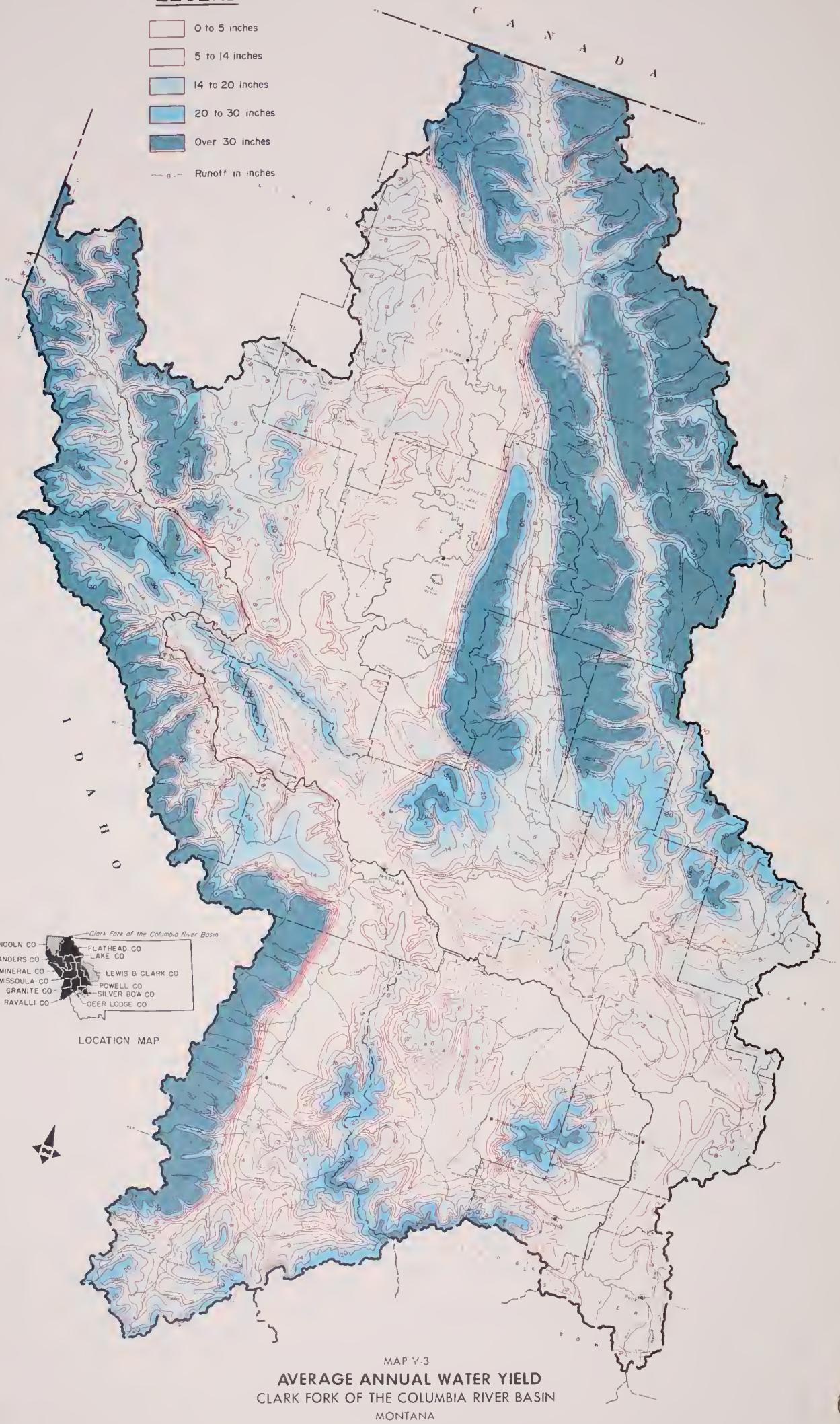

LEGEND
MINERAL CO
MISSOULA CO
GRANITE CO
RAVALLI CO
LEWIS & CLARK CO
POWELL CO
SILVER BOW CO
DEER LODGE CO
LOCATION MAP
N
MAP V 2
AVERAGE ANNUAL PRECIPITATION
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10
0
10
20 MILES

Source
Base map prepared by SCS, Portland Cartog. Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.
U.S. DEPARTMENT OF AGRICULTURE

M7-SN-23425-4


LEGEND
LOCATION MAP
MAP V 3
AVERAGE ANNUAL WATER YIELD
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10
20 MILES



MAP V-3

AVERAGE ANNUAL WATER YIELD

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

SCALE 1 : 1,000,000

Source:
Base maps prepared by SCS, Portland Cartog. Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.
U.S. DEPARTMENT OF AGRICULTURE

M7-SN-23425-5

TABLE V-2--MONTHLY TEMPERATURE AVERAGES AND EXTREMES FOR SELECTED LOCATIONS
CLARK FORK OF THE COLUMBIA RIVER BASIN

Month	BUTTE			HAMILTON			KALISPELL			MISSOULA			THOMPSON FALLS		
	Average Monthly Temp. 1/	Highest Temp. of Record 1/	Lowest Temp. of Record 1/	Average Monthly Temp. 2/	Highest Temp. of Record 2/	Lowest Temp. of Record 2/	Average Monthly Temp. 3/	Highest Temp. of Record 3/	Lowest Temp. of Record 3/	Average Monthly Temp. 3/	Highest Temp. of Record 3/	Lowest Temp. of Record 3/	Average Monthly Temp. 3/	Highest Temp. of Record 3/	Lowest Temp. of Record 3/
	- - -	- - -	- - -	- - -	- - -	- - -	Degrees Fahrenheit	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
January	14.2	54	-48	24.1	61	-36	19.1	51	-26	22.7	44	-16	26.5	56	-36
February	18.8	60	-52	29.9	69	-36	25.0	56	-23	22.4	43	-12	33.0	64	-30
March	27.2	64	-36	36.6	74	-14	30.5	71	-29	33.0	52	5	38.0	78	10
April	36.2	79	-13	46.4	90	1	42.0	81	12	39.3	64	16	46.9	90	17
May	46.9	88	12	54.2	102	21	50.9	89	20	[illegible]	84	27	55.0	97	[illegible]
June	54.5	93	23	60.1	99	29	57.0	93	28	55.4	81	33	61.2	100	[illegible]
July	62.4	100	29	67.9	101	37	64.3	104	31	71.8	100	46	68.5	109	35
August	60.0	99	27	65.9	102	34	62.5	105	31	62.1	93	35	67.2	107	32
September	50.0	91	12	57.6	95	25	53.3	99	16	56.1	86	30	59.2	106	24
October	41.0	[illegible]	-19	47.2	86	-1	42.5	81	5	43.6	79	25	48.1	89	[illegible]
November	28.2	68	-34	34.2	71	-24	30.7	65	-28	30.4	65	-5	36.3	65	-13
December	18.5	67	-37	28.7	66	-31	23.7	55	-35	25.7	59	-1	30.1	58	[illegible]

1/ Data for Butte are through 1950 only.
2/ 1935 to 1964.
3/ 1941 to 1970
Source: Local Climatological Data - U. S. Weather Service

TABLE V-3--NORMAL ANNUAL GROWING SEASON EFFECTIVE PRECIPITATION FOR SELECTED LOCATIONS AND CROPS

CLARK FORK OF THE COLUMBIA RIVER BASIN

Locations	Alfalfa	Grain	Grass	Orchards	Potatoes
	- - - - - - - - - - - - Inches - - - - - - - - - - - -
Bigfork	7.86	5.99	7.97	7.86	4.64
Creston	6.23	5.53	6.82	6.22	4.48
Darby	4.25	3.65	5.19	4.25	---
Deer Lodge	4.38	4.37	5.18	---	3.04
Drummond	4.01	3.95	4.87	---	---
Elliston	4.62	4.82	5.79	---	---
Hamilton	4.66	3.67	5.06	4.66	3.08
Kalispell	5.99	4.87	6.02	5.99	4.20
Lone Pine	3.86	3.02	4.15	---	---
Missoula	4.94	4.23	5.37	4.94	3.17
Ovando	3.26	3.79	4.99	---	---
Philipsburg	4.53	4.18	5.97	---	---
Polson	5.98	4.54	6.06	5.98	3.56
St. Ignatius	6.13	5.00	6.32	6.10	3.44
Stevensville	4.20	3.69	5.04	4.20	2.70
Superior	4.77	4.17	5.71	---	---
Thompson Falls	5.83	4.42	6.46	---	---
AVE	5.03	4.35	5.70	5.58	3.59

Much of the basin is underlain by sedimentary rocks such as limestone, sandstone, and shale formed when seas once covered Montana. Younger sedimentary and volcanic formations cover the older formations. Sedimentary alluvial materials underlay much of the soils in the valley bottoms now used for agriculture, houses, cities, roads, and other activities of man. Map V-4 is a generalized map of geologic formations occurring at the ground surface in the basin.

Mineral Resources

The basin contains a wide variety of mineral deposits. The processing of ores mined in the basin or imported to the basin consumes water in smeltering and in the handling of wastes.

Metal ores

Copper is the single most important metal ore in Montana. Over 99 percent of the state's production comes from the Butte district. Essentially, all of the Butte copper has been produced from a pit and other mines in an area two and one-half miles wide by five miles long. If market conditions permit, the Butte area can produce over 100,000 tons of copper annually for an extended period. However, the highest grade ores have been mined and current ores are averaging around 0.5 percent copper. Copper ore is also found at other locations in the basin, especially in Lewis and Clark and Granite Counties.

Montana currently ranks about ninth among the gold producing states. Most of Montana's production is a by-product from the copper mining at Butte. With the recent marked increase in gold prices, there has been an increase in gold mining activity.

It appears that Montana contains enough iron ore for a moderate-size iron and steel industry. The major iron ores include magnetite, hematite, and limonite. The deposits are located in Granite County near Philipsburg where intrusive rocks contacted limestones and shales. The slag pile at Anaconda can also be used as a source of iron. This slag dump may contain about 40 million tons of material, as much as 45 percent of which may be iron.

Since 1957 Montana has ranked third or fourth in silver production, but the amount produced has been steadily declining. As with gold, most is obtained as a by-product to copper mining. The second most important deposits are near Philipsburg.

Lead and zinc are obtained from zinc-lead-bearing veins peripheral to the copper ores and in other locations. Lead-zinc-rich veins in the Butte district have produced a fifth of all the lead credited to Montana. About

90 percent of Montana's zinc comes from the Butte mines, though it is nearly independent from copper mining.

By the end of 1961 Montana was the only state producing high grade manganese ores or concentrates. Most comes from the Butte and Philipsburg districts. However, the Anaconda Company has not produced any manganese since 1959. Competition from low-cost imported manganese limits Montana's production.

Arsenic and bismuth are produced as by-products at Anaconda's smelter. Bismuth is rare in the United States. Arsenic is produced from enargite, an important copper ore mineral at Butte. The present supply of arsenic far exceeds the demand. Molybdenite also occurs with the copper deposits.

Known locations of important nonfuel metals and nonmetallic ores are shown on map V-5. Imported alumina is processed into aluminum in a plant at Columbia Falls. Electricity for this plant is produced mainly at Hungry Horse dam nearby.

In 1952 and 1953 Montana was the fourth largest tungsten producing state. By 1962 there were no operating tungsten mines in Montana. In Deer Lodge and Granite Counties, tungsten is found in quartz veins near granite intrusives in the Flint Creek and Anaconda mountains. The chief production has come from a placer deposit near Philipsburg.

Several small deposits of uranium ores are known. A few deposits appear to have economic potential.

Nonmetallic minerals

By far the most important gems occurring in Montana are the sapphires. Sapphires are the colorless, yellow, or blue varieties of the mineral corundum. Lower quality sapphires are used as abrasives. The more important sapphire mines in the basin are southwest of Philipsburg in Granite County.

There are two barite mines in Missoula County. Known deposits also occur in Ravalli County. Most barite is used in drilling muds or as white pigment in paints.

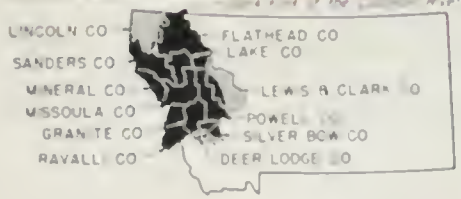
Siliceous fire clay is mined at a pit on Lost Creek just north of Anaconda and is used as refractories in the Anaconda Company's smelter. Two members of the mica group (muscovite and vermiculite) have been mined in Montana. Apparently commercial deposits of muscovite occur in Missoula County and vermiculite near Hamilton in Ravalli County, but have not been mined.

LEGEND

Qal Alluvium

PP-Ku Pennsylvanian to Cretaceous Sedimentary Rocks, Undifferentiated

Cu-D Cambrian through Devonian Sedimentary Rocks, Undivided



LOCATION MAP

MAP V 4

GENERALIZED GEOLOGY

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

M7-SN-23425-2

90 percent of Montana's zinc comes from the Butte mines, though it is nearly independent from copper mining.

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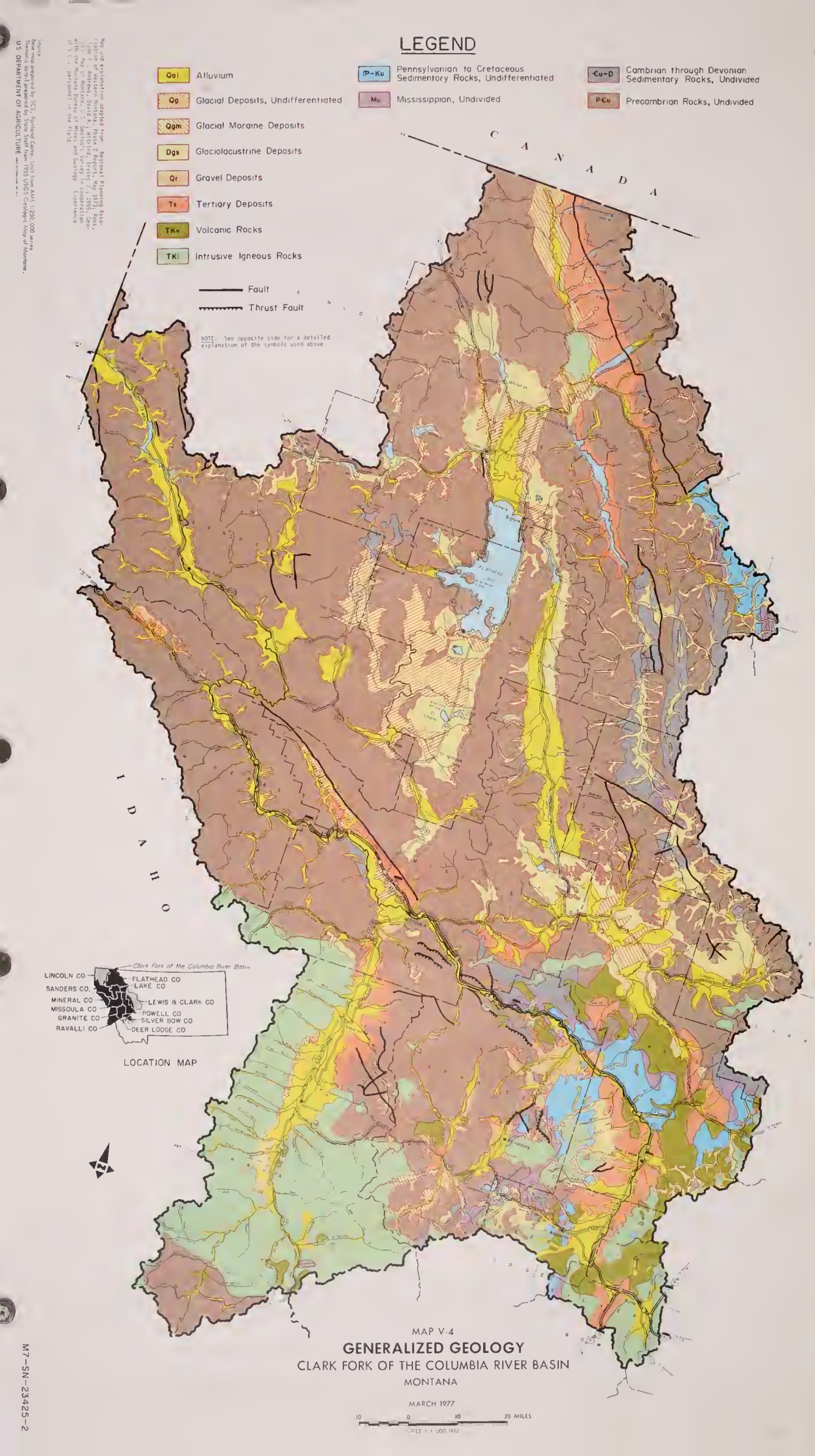
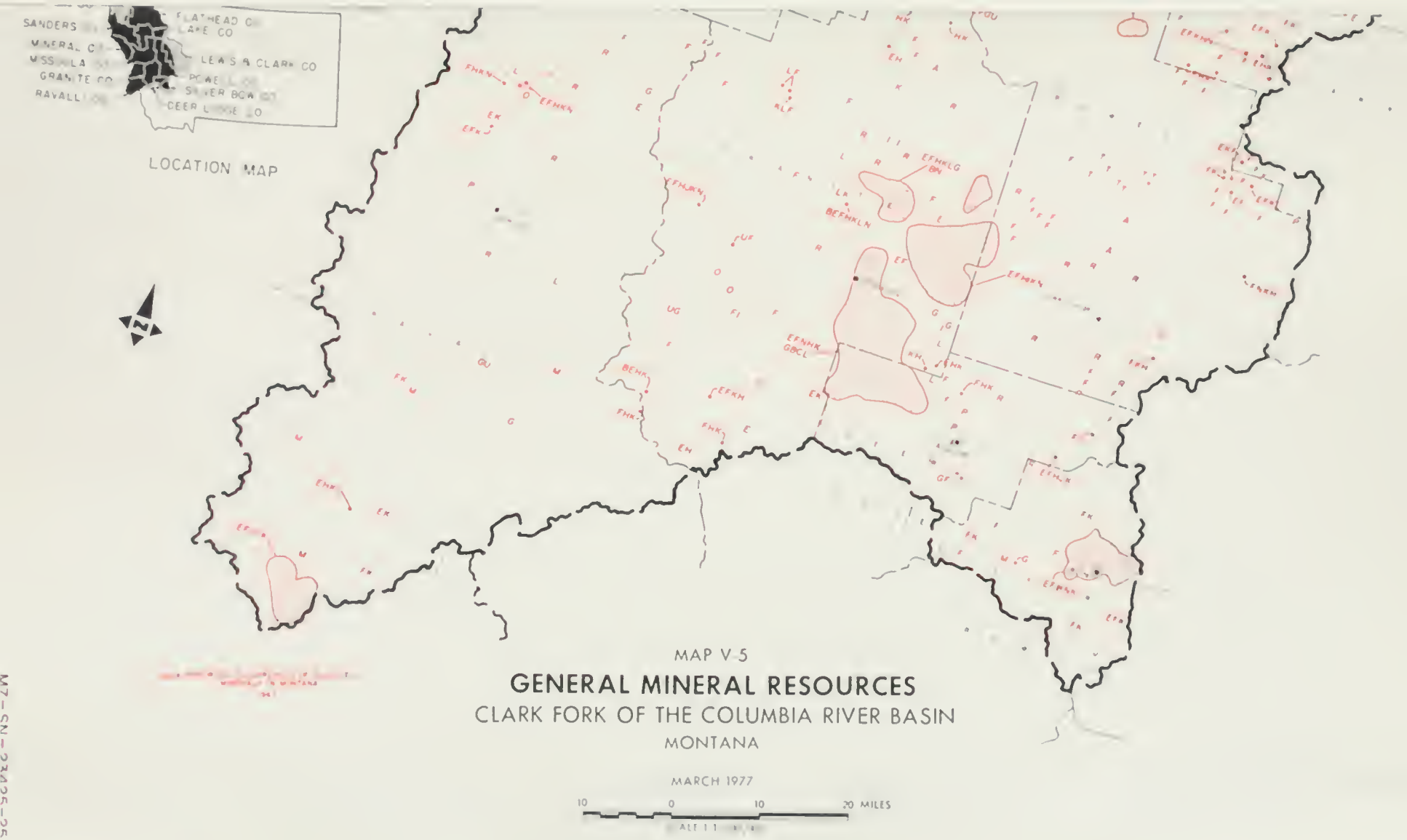

LEGEND
Qal Alluvium
Qg Glacial Deposits, Undifferentiated
Qgm Glacial Moraine Deposits
Dgs Glaciolacustrine Deposits
Qr Gravel Deposits
Ts Tertiary Deposits
TKv Volcanic Rocks
TKi Intrusive Igneous Rocks
Fault
Thrust Fault
NOTE: See opposite side for a detailed explanation of the symbols used above
IP-Ku Pennsylvanian to Cretaceous Sedimentary Rocks, Undifferentiated
Mu Mississippian, Undivided
Cu-D Cambrian through Devonian Sedimentary Rocks, Undivided
PCu Precambrian Rocks, Undivided
Map and explanation adapted from: Regional Planning Association of Western Montana, Phase 2, Report, May 1973, Ross-Lyde P.; Andrews, David A.; Wilmot, Irving J.; 1955, Geologic Map of Montana, U. S. Geological Survey in cooperation with the Montana Bureau of Mines and Geology
Source
Base prepared by SCS, Portland Cartographic Unit from AMS 1:250,000 series
Thematic prepared by SCS, Cartographic Unit from 1955 USGS Geologic Map of Montana.
U.S. DEPARTMENT OF AGRICULTURE
CANADA
IDAHO
Clark Fork of the Columbia River Basin
LINCOLN CO
SANDERS CO.
MINERAL CO
MISSOULA CO
GRANITE CO
RAVALLI CO
FLATHEAD CO
LAKE CO
LEWIS & CLARK CO
POWELL CO
SILVER BOW CO
DEER LODGE CO
LOCATION MAP
MAP V-4
GENERALIZED GEOLOGY
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10 0 10 20 MILES
M7-SN-23425-2

EXPLANATION OF GEOLOGIC SYMBOLS

Penn to Cr		quartzite, and other minor (in this context) formations. The Colorado shale is a dark-colored marine shale with a total measured section of approximately 2000 feet.	sources of ground water.
Mississippian	Mu	MISSISSIPPIAN, UNDIVIDED - By far the dominant formation in this group is the Madison group. Predominantly limestones, in part dolomitic, with lesser amounts of sandstone and shale. Generally a massive and erosion-resistant formation. Cavernous in parts, especially the upper Madison section.	Upper portion of the formation is considered a good ground water aquifer. Yields vary from 0-1000 gpm. Water quality is normally excellent for domestic and irrigation supply.
Cambrian through Devonian	€u-D	CAMBRIAN THROUGH DEVONIAN SEDIMENTARY ROCKS, UNDIVIDED - Includes Three Forks formation, Jefferson limestone, Maywood formation, Hasmark formation, Silver Hill formation, Park shale, Meagher limestone, Wolsey shale, Flathead quartzite. Shales, limestones, quartzites, and sandstones.	This section is normally hard and massive. Water transmissibility is low. Large yields can be obtained in fracture zones. Average yields 0-15 gpm.
Precambrian	P€u	PRECAMBRIAN ROCKS, UNDIVIDED - Predominantly Belt Series metasedimentary rocks with a few pre-Belt metamorphic rocks. Argillites, limestones, quartzites, and shales.	Yields adequate supplies of ground water for domestic and livestock use. Water quality is moderately good. Yields range from 2-10 gpm.


SANDERS
FLATHEAD CO
LAKE CO
LEWIS & CLARK CO
GRANITE CO
SILVER BOW CO
CEER LODGE CO
LOCATION MAP
MAP V-5
GENERAL MINERAL RESOURCES
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10 0 10 20 MILES

EXPLANATION OF GEOLOGIC SYMBOLS

Penn to Ci		quartzite, and other minor (in this context) formations. The Colorado shale is a dark-colored marine shale with a total measured section of approximately 2000 feet.	sources of ground water.
Mississippian	Mu	MISSISSIPPIAN, UNDIVIDED - By far the dominant formation in this group is the Madison group. Predominantly limestones, in part dolomitic, with lesser amounts of sandstone and shale. Generally a massive and erosion-resistant formation. Cavernous in parts, especially the upper Madison section.	Upper portion of the formation is considered a good ground water aquifer. Yields vary from 0-1000 gpm. Water quality is normally excellent for domestic and irrigation supply.
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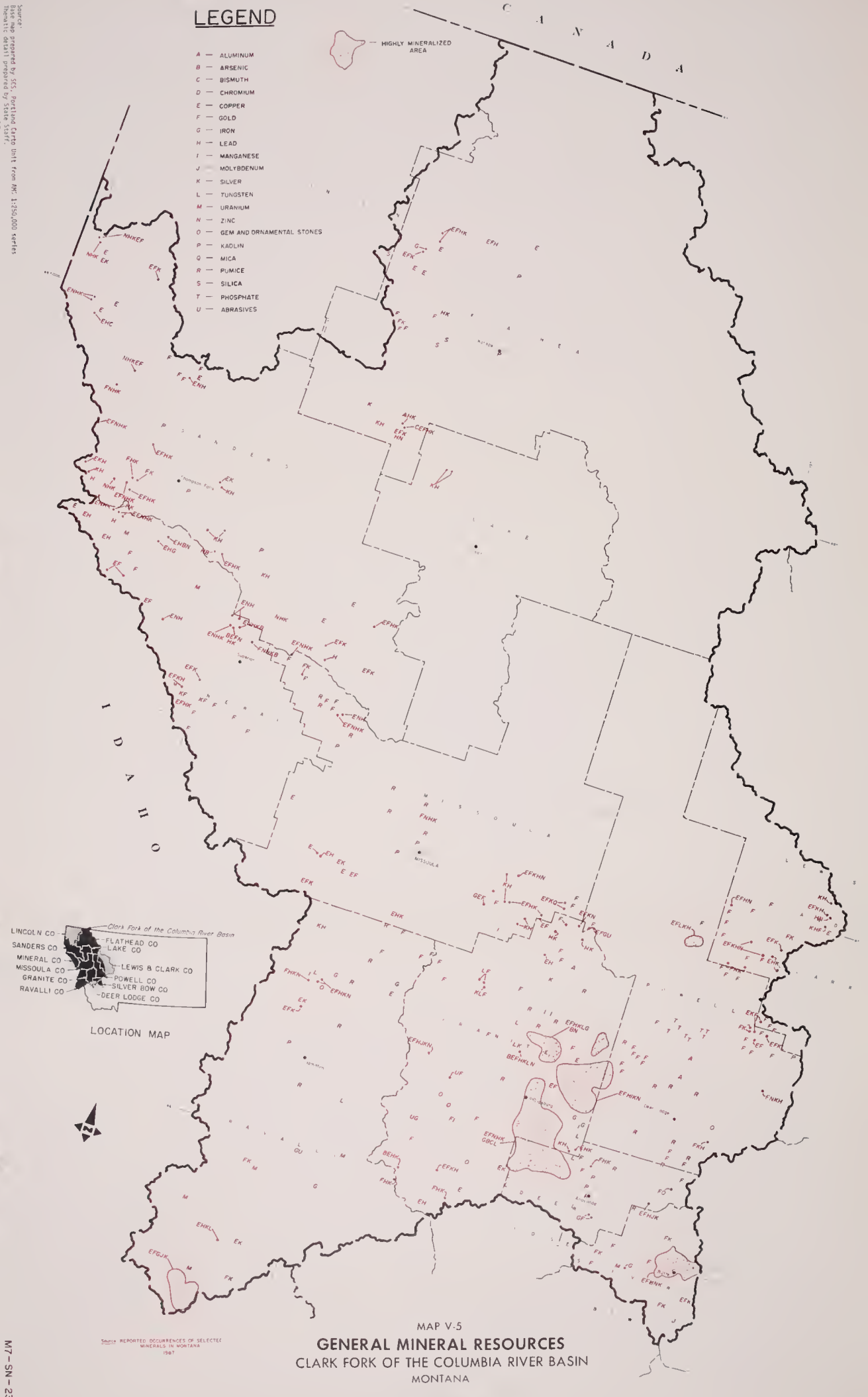


MAP V-5

GENERAL MINERAL RESOURCES

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

Source: Base map prepared by SCS, Portland Cartographic Unit from NMS 1:250,000 series
Thematic detail prepared by State Staff.
US DEPARTMENT OF AGRICULTURE

M7-SN-23425-25

Phosphates are mined at several locations in Powell County. Another mine is near Maxville in Granite County. Montana ranks fourth in phosphate production. Phosphates mined in this area are processed in Canada. Phosphates from other areas are processed at Rocker near Butte.

Silica has been produced from crushed rock from the Quadrant sandstone. Outcrops of this formation occur in Powell, Deer Lodge, and Granite Counties. Clays, sands, and gravels are quarried for construction materials in the basin.

Mineral fuels and geothermal resources

Minor coal deposits are known near the Canadian boundary in Flathead County. Areas along the North and Middle Forks of the Flathead River may soon be explored for oil and natural gas; extent of the deposits are unknown.

Interest in geothermal energy sources has led to some exploration work in eastern Sanders County. Reports so far are that temperatures are not high enough to develop steam-electric generation.

Water Use by the Metals Industry

Water use by the mineral industries in the basin is dominated by the Anaconda Company operations at Butte, Anaconda, and Columbia Falls. The Butte reduction works and the Anaconda arbiter plant use up to three million gallons per day while the Anaconda refinery uses about 33 mgd. The Anaconda aluminum plant at Columbia Falls uses approximately 4.5 mgd of ground water. The remaining metals processing industries use very small amounts of water. Other industrial water uses are discussed later in this chapter.

Topography and Soils

The topography of the basin consists of a contrast of steep mountain slopes and flat river valleys with some well-defined terraces, but relatively few foothills or prairie expanses. (See map II-2.) Climate varies with elevation, landform, and orientation of slopes. With variation in climate and geology, there is variation in vegetative cover and the development of soils. Most of the soils in the basin were developed on mountain slopes under conifer forests. Lesser acreages of soils developed under tall and short grassland conditions in the valleys. Along the river bottoms, shallow cobbly and gravelly soils have developed. On outwash terraces and fans, deeper and more productive soils were formed. Above the alluvial terraces, soils were often developed directly from talus. In some areas, old lakebed sediments provided parent materials. Most of the basin had hard rock materials rather than shales as parent materials. As a result,

there are larger acreages of coarser textured soils than of clays. Intensive soil surveys are not completed for the entire basin, but generalized soils data are presented on map V-6.

Vegetative Cover

Vegetative cover as described here relates to existing cover rather than potential vegetation. Map V-7 illustrates a generalized pattern of existing vegetation based on nine broad vegetation groups. Table V-4 shows: the representative vegetative species found in each of the nine groups; physical factors affecting the vegetative patterns; and uses made of vegetative groups.

Land Ownership

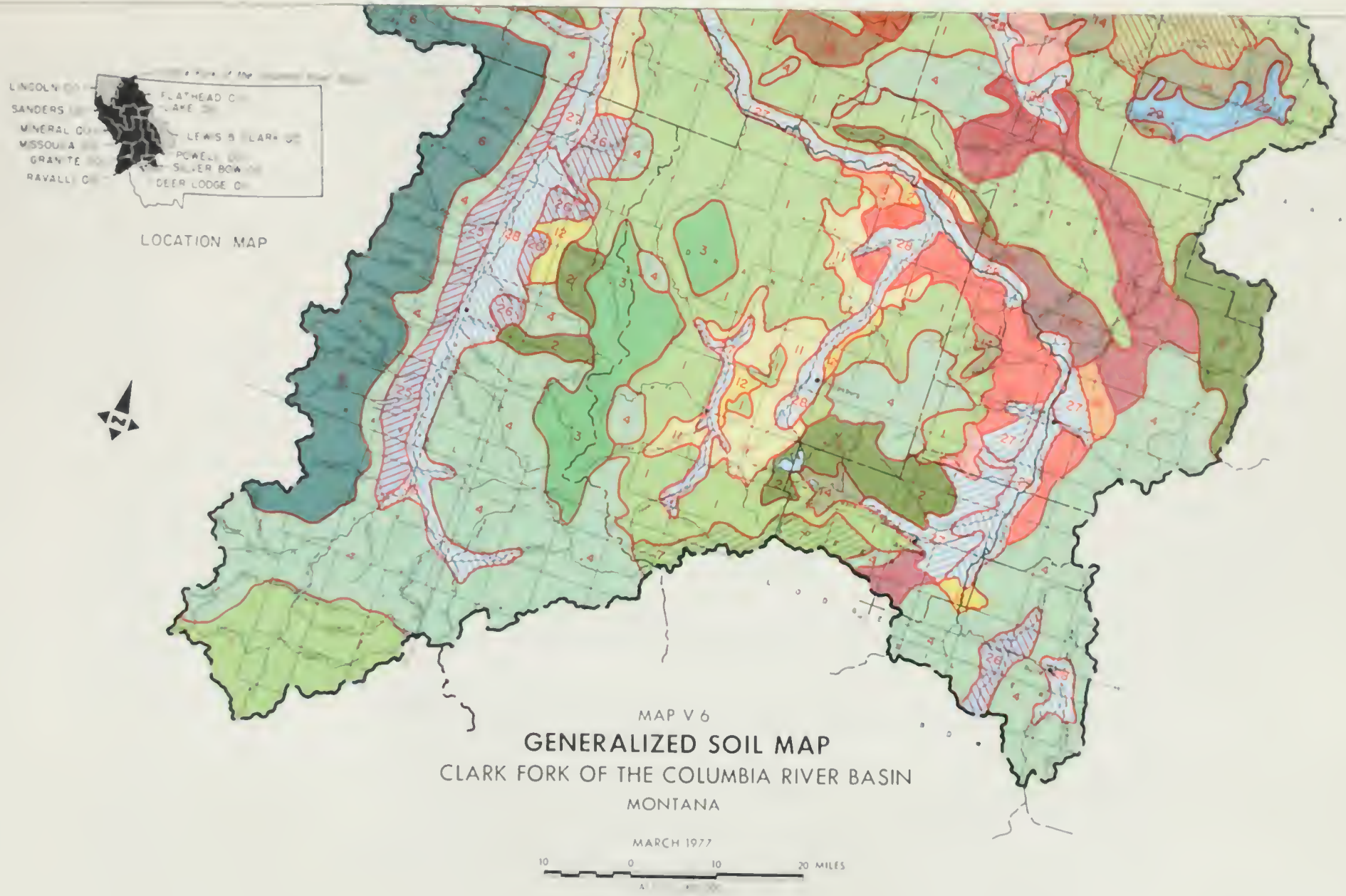
Since land ownership is one of the most important factors affecting resource development, a description of major types of land ownership is presented in table V-5 and on map V-8. Federal land ownership includes about 7.8 million acres or about 57.8 percent of the land area in the ten counties. State-owned land includes about 612,000 acres (4.5 percent); Indians own about 617,000 acres (4.6 percent); and other private lands include about 4.5 million acres (33.1 percent).

Land Use

Table V-6 lists major land uses by county for the ten-county study area. Map V-9 shows general land use in the river basin.

Rangelands

The next largest land use is nonforested rangeland. About 1,645,000 acres are in rangeland, most of which is grazed by cattle and a few sheep. This land is also vital to grazing big game animals and other wildlife species. About 2.3 million acres of forest land are also grazed, though the livestock forage obtained from forested land is very small compared with range and pasture lands. Less than 10 percent of the nonforest rangeland is on federal land. Approximately 60 percent of the rangeland is in only poor or fair condition. Map V-10 is a map showing range and grazable forest by condition.


LINCOLN CO.
SANDERS CO.
MINERAL CO.
MISSOULA CO.
GRANITE CO.
RAVALLI CO.
FLATHEAD CO.
LAKE CO.
LEWIS & CLARK CO.
POWELL CO.
SILVER BOW CO.
DEER LODGE CO.
LOCATION MAP
MAP V 6
GENERALIZED SOIL MAP
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10 0 10 20 MILES

there are larger acreages of coarser textured soils than of clays. Intensive soil surveys are not completed for the entire basin, but generalized soils data are presented on map V-6.

Vegetative Cover

Vegetative cover as described here relates to existing cover rather than potential vegetation. Map V-7 illustrates a generalized pattern of existing vegetation based on nine broad vegetation groups. Table V-4 shows: the representative vegetative species found in each of the nine groups; physical factors affecting the vegetative patterns; and uses made of vegetative groups.

Land Ownership

Since land ownership is one of the most important factors affecting resource development, a description of major types of land ownership is presented in table V-5 and on map V-8. Federal land ownership includes about 7.8 million acres or about 57.8 percent of the land area in the ten counties. State-owned land includes about 612,000 acres (4.5 percent); Indians own about 617,000 acres (4.6 percent); and other private lands include about 4.5 million acres (33.1 percent).

Land Use

Table V-6 lists major land uses by county for the ten-county study area. Map V-9 shows general land use in the river basin.

Rangelands

The next largest land use is nonforested rangeland. About 1,645,000 acres are in rangeland, most of which is grazed by cattle and a few sheep. This land is also vital to grazing big game animals and other wildlife species. About 2.3 million acres of forest land are also grazed, though the livestock forage obtained from forested land is very small compared with range and pasture lands. Less than 10 percent of the nonforest rangeland is on federal land. Approximately 60 percent of the rangeland is in only poor or fair condition. Map V-10 is a map showing range and grazable forest by condition.

SOILS OF THE MOUNTAINS

1 CRYOCHREPTS-USTOCHREPTS
2 USTOCHREPTS-CRYOCHREPTS
3 CRYOCHREPTS-CRYANDEPTS
4 CRYOCHREPTS-USTOCHREPTS-USTORTHENTS
5 CRYOCHREPTS-USTOCHREPTS-EUTROBORALFA
6 CRYOCHREPTS-ROCK OUTCROP
7 CRYOCHREPTS, CALCAREOUS, HIGH ELEVATION
8 CRYOCHREPTS-CRYANDEPTS
9 CRYOCHREPTS, HIGH ELEVATION
10 CRYOCHREPTS-CRYOBORALFS

SOILS OF THE HIGH TERRACES AND MOUNTAIN FOOTHILLS

11 HAPLOBOROLLS-CRYOBOROLLS
12 CRYOBOROLLS-CALCIBOROLLS-CALCIORTHIOS
13 USTOCHREPTS-USTORTHENTS
14 CRYOCHREPTS-CRYOBORALFS-USTOCHREPTS
15 EUTROBORALFS-ARGIBOROLLS
16 HAPLOBOROLLS-USTOCHREPTS-CRYOCHREPTS
17 ARGIBOROLLS-NATRIBOROLLS
18 CRYOBOROLLS-CRYORTHENTS
19 NATRARGIOS-EUTROBORALFS-ARGIBOROLLS
20 HAPLOBOROLLS-NATRIBOROLLS-CAMBORTHIDS
21 HAPLOBOROLLS-USTIPSAMMENTS
22 ARGIBOROLLS-CALCIBOROLLS
23 HAPLOBOROLLS-USTORTHENTS
24 CRYOBOROLLS-ARGIBOROLLS

SOILS OF THE FLOOD PLAINS, TERRACES AND ALLUVIAL FANS

25 HAPLOBOROLLS-USTOCHREPTS
26 HAPLOBOROLLS-ARGIBOROLLS-CRYOBOROLLS
27 USTIFLUVENTS-HAPLOBOROLLS-USTORTHENTS
28 USTIFLUVENTS-HAPLUDOLLS
29 USTIPSAMMENTS-EUTROCHREPTS

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts

NOTE See reverse side for detailed legend

Source:
Base map prepared by SCS, Portland Cartog. Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.
US DEPARTMENT OF AGRICULTURE

CANADA

IDAHO

LOCATION MAP

Clark Fork of the Columbia River Basin

LINCOLN CO
SANDERS CO
MINERAL CO
MISSOULA CO
GRANITE CO
RAVALLI CO
FLATHEAD CO
LAKE CO
LEWIS & CLARK CO
POWELL CO
SILVER BOW CO
DEER LODGE CO

MAP V 6

GENERALIZED SOIL MAP

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

SCALE 1:1,000,000

M7-SN-23425-3

21. HAPLOBOROLLS-USTIPSAMMENTS
Nearly level to sloping, deep, well-drained soil on glaciofluvial and eolian fans and terraces.

22. ARGIBOROLLS-CALCIBOROLLS
Nearly level to strongly sloping, deep, well-drained, calcareous soils on benches and terraces.

23. HAPLOBOROLLS-USTORTHENTS
Gently sloping to moderately steep, shallow to deep, well-drained soils over shales or siltstone on rolling hills, benches, and terraces.

24. CRYOBOROLLS-AGRIBOROLLS
Nearly level to strongly sloping, deep, well-drained soils on alluvial benches and terraces in uplands.

SOILS OF THE FLOODPLAINS, TERRACES AND ALLUVIAL FANS

25. HAPLOBOROLLS-USTOCHREPTS
Nearly level to sloping, shallow to deep, well-drained soils on glacial morains, fans, and terraces.

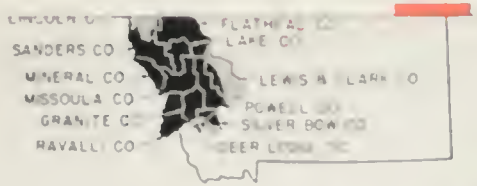
26. HAPLOBOROLLS-AGRIBOROLLS-CRYOBOROLLS
Gently sloping to moderately steep, shallow to deep, well-drained soils on low benches and terraces.

27. USTIFLUVENTS-HAPLOBOROLLS-USTORTHENTS
Nearly level to gently sloping, shallow to deep, well to somewhat poorly-drained soils on flood plains, fans, and low terraces.

28. USTIFLUVENTS-HAPLUDOLLS
Nearly level to gently sloping, shallow to deep, well to poorly-drained soils on flood plains, fans, and low terraces.

29. USTIPSAMMENTS-EUTROCHREPTS
Nearly level to sloping, deep, well to poorly-drained soils on flood plains, fans, and terraces.

LEGEND



LOCATION MAP

MAP V 7

GENERAL VEGETATION TYPES

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

M7-SN-23425-7

21. HAPLOBOROLLS-USTIPSAMMENTS
Nearly level to sloping, deep, well-drained soil on glaciofluvial and eolian fans and terraces.

22. ARGIBOROLLS-CALCIBOROLLS
Nearly level to strongly sloping, deep, well-drained, calcareous soils on benches and terraces.

23. HAPLOBOROLLS-USTORTHENTS
Gently sloping to moderately steep, shallow to deep, well-drained soils over shales or siltstone on rolling hills, benches, and terraces.

24. CRYOBOROLLS-AGRIBOROLLS
Nearly level to strongly sloping, deep, well-drained soils on olluvial benches and terraces in uplands.

SOILS OF THE FLOODPLAINS, TERRACES AND ALLUVIAL FANS

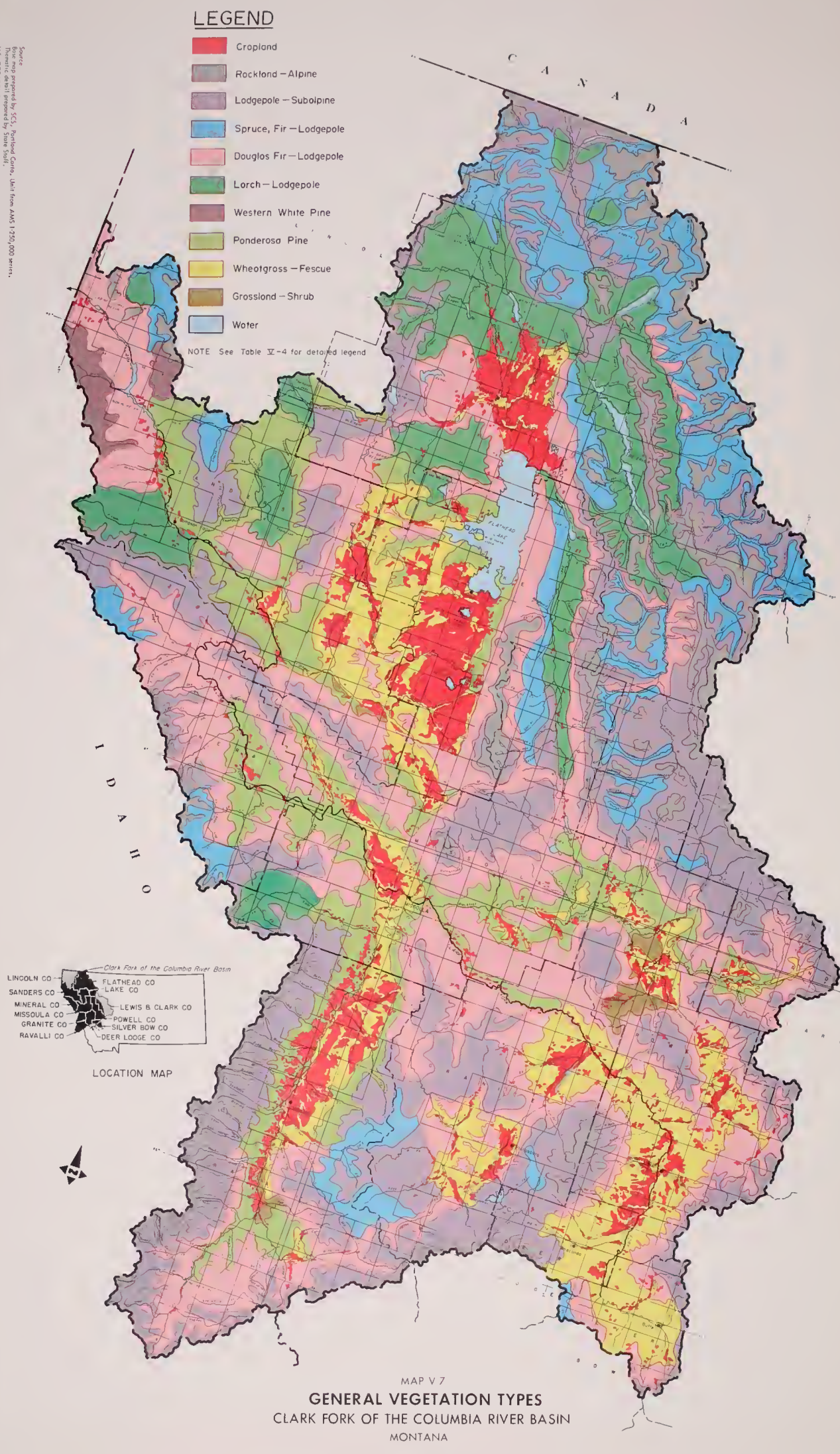
25. HAPLOBOROLLS-USTOCHREPTS
Nearly level to sloping, shallow to deep, well-drained soils on glacial morains, fans, and terraces.

26. HAPLOBOROLLS-AGRIBOROLLS-CRYOBOROLLS
Gently sloping to moderately steep, shallow to deep, well-drained soils on low benches and terraces.

27. USTIFLUVENTS-HAPLOBOROLLS-USTORTHENTS
Nearly level to gently sloping, shallow to deep, well to somewhat poorly-drained soils on flood plains, fans, and low terraces.

28. USTIFLUVENTS-HAPLUDOLLS
Nearly level to gently sloping, shallow to deep, well to poorly-drained soils on flood plains, fans, and low terraces.

29. USTIPSAMMENTS-EUTROCHREPTS
Nearly level to sloping, deep, well to poorly-drained soils on flood plains, fans, and terraces.



Source
Base map prepared by SCS, Portland Cartog. Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.
U.S. DEPARTMENT OF AGRICULTURE

MAP V 7

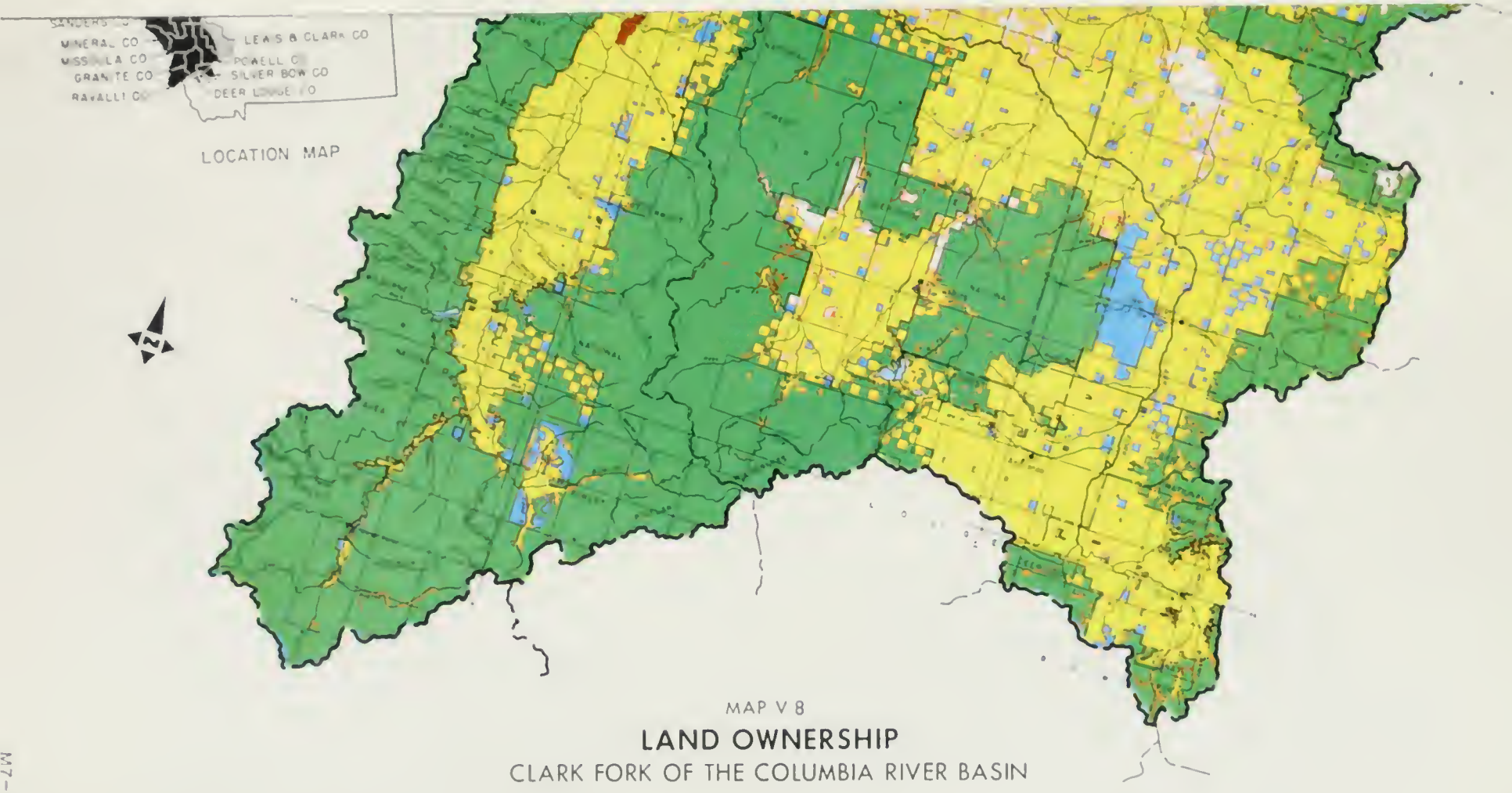
GENERAL VEGETATION TYPES

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

M7-SN-23425-7



MAP V 8

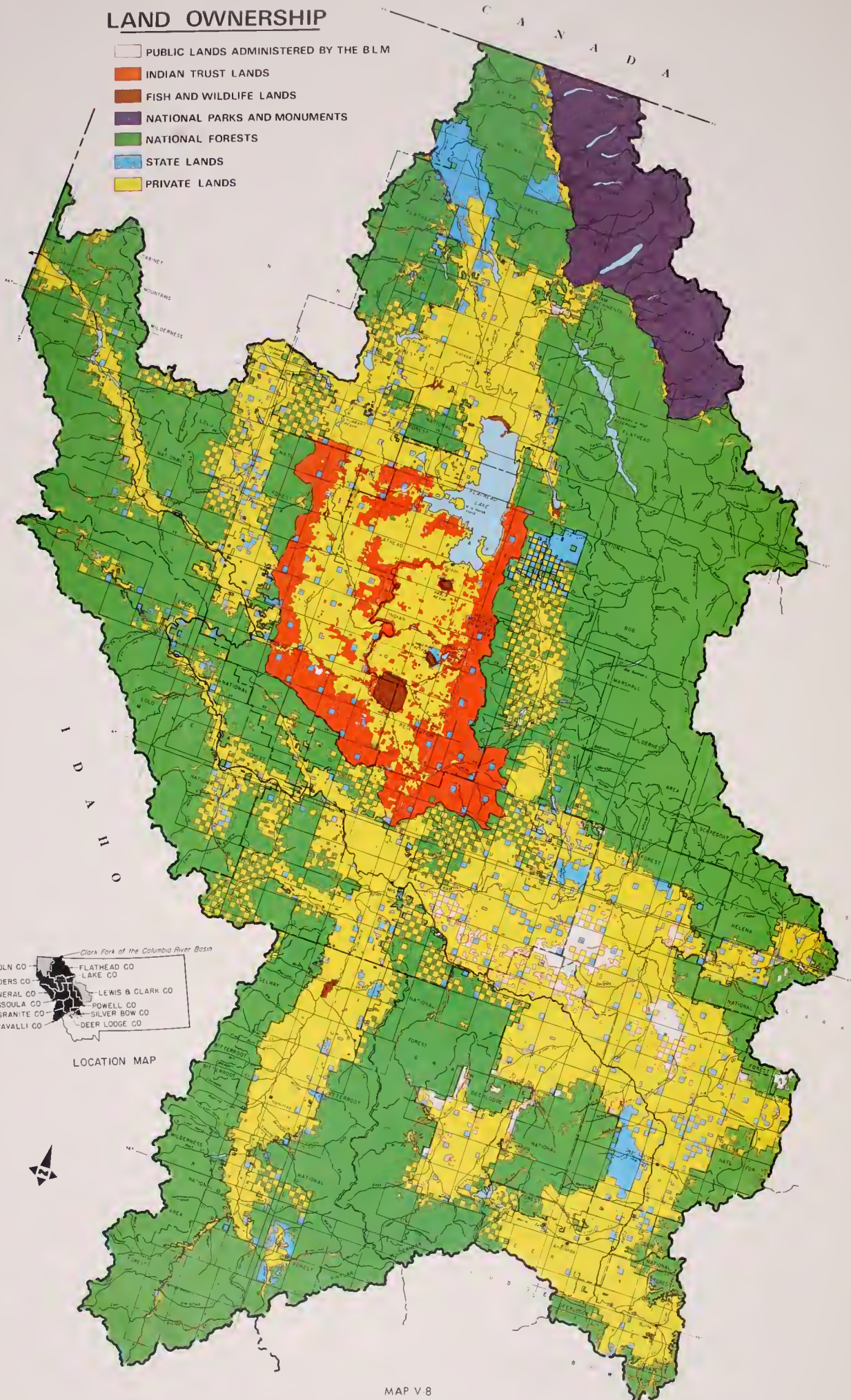
LAND OWNERSHIP

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

M7-SN-23425-1



Source:
Base map prepared by SCS, Portland Cartographic Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff from BLM, SCS, BIA and USFS maps.
U.S. DEPARTMENT OF AGRICULTURE

MAP V-8

LAND OWNERSHIP

CLARK FORK OF THE COLUMBIA RIVER BASIN

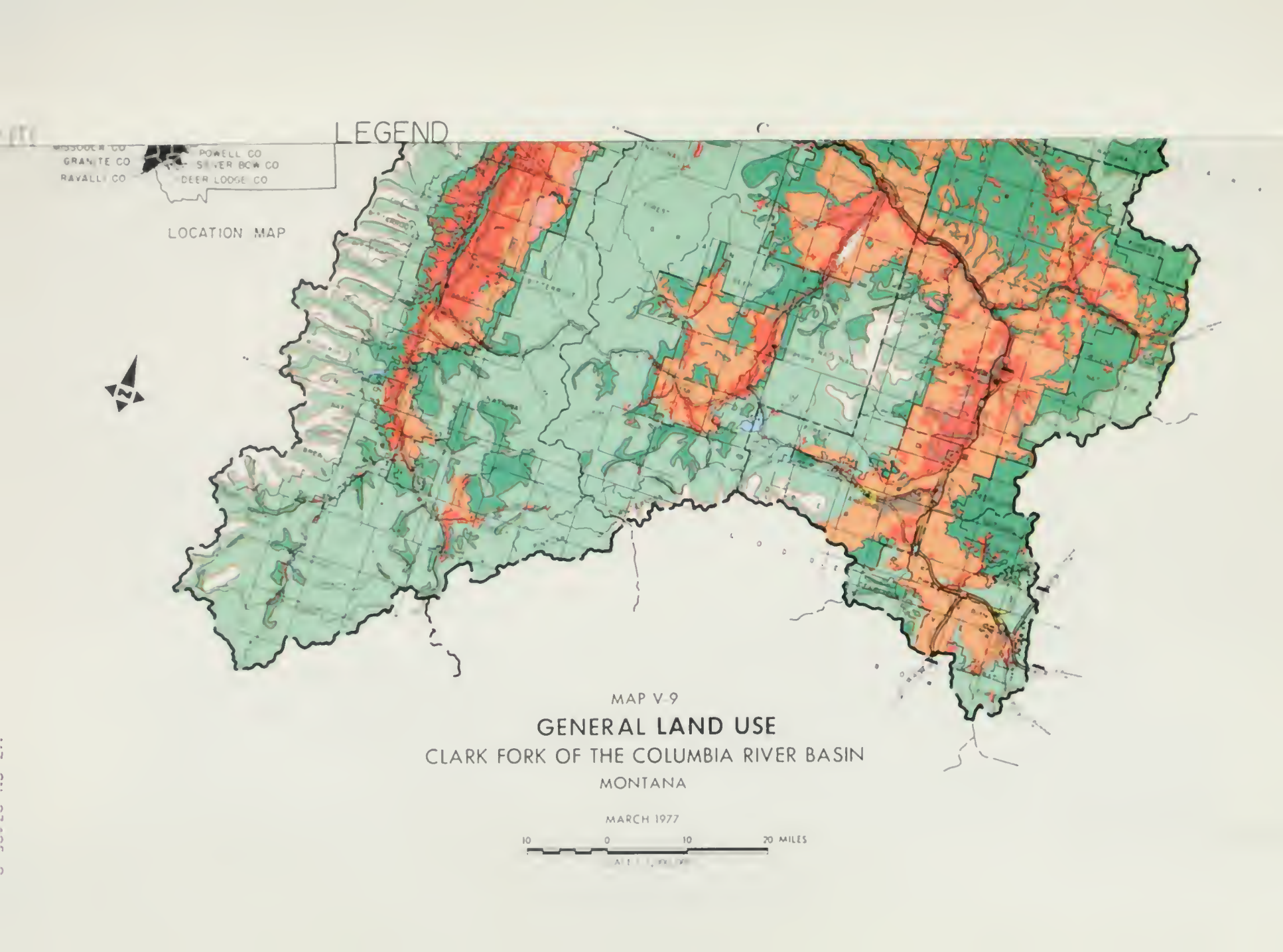
MONTANA

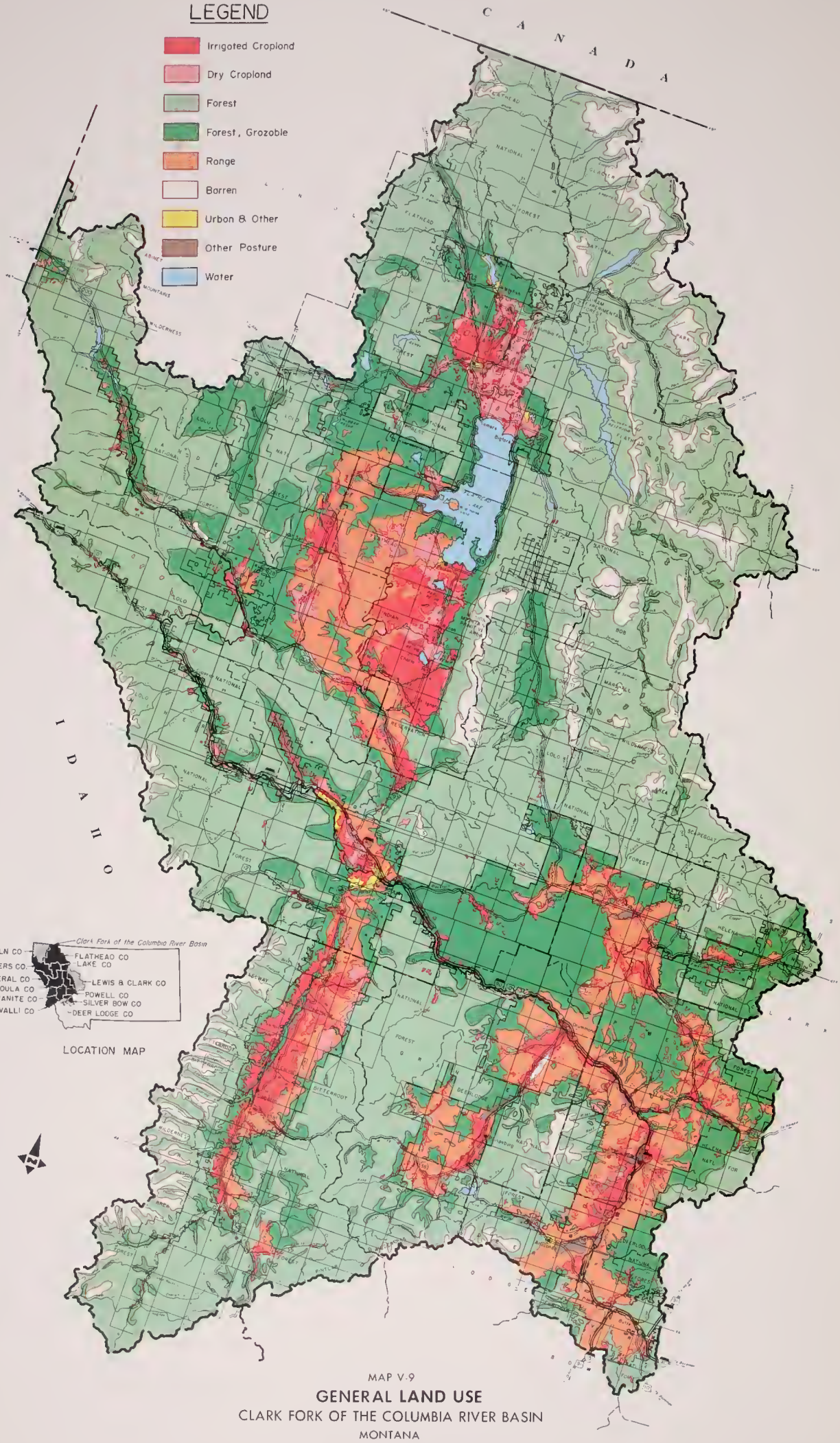
MARCH 1977

10 0 10 20 MILES

SCALE 1:1,000,000

M7-SN-23425-1


LEGEND
GRANITE CO
POWELL CO
SILVER BOW CO
DEER LODGE CO
LOCATION MAP
MAP V-9
GENERAL LAND USE
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10
0
10
20 MILES



Source:
Base map prepared by SCS, Portland Cartg. Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.
U.S. DEPARTMENT OF AGRICULTURE

MAP V-9

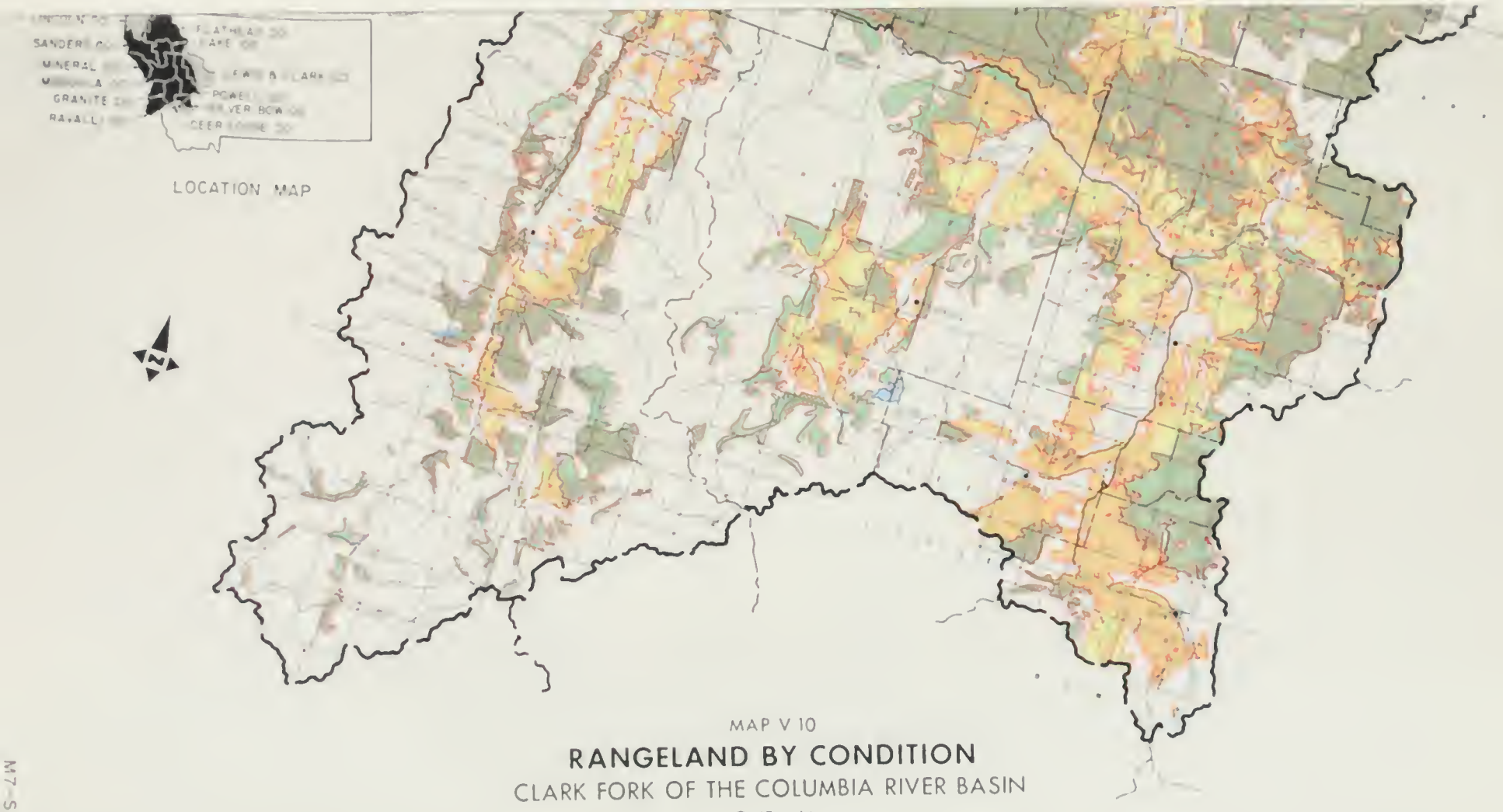
GENERAL LAND USE

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

M7-SN-23425-9



MAP V 10

RANGELAND BY CONDITION

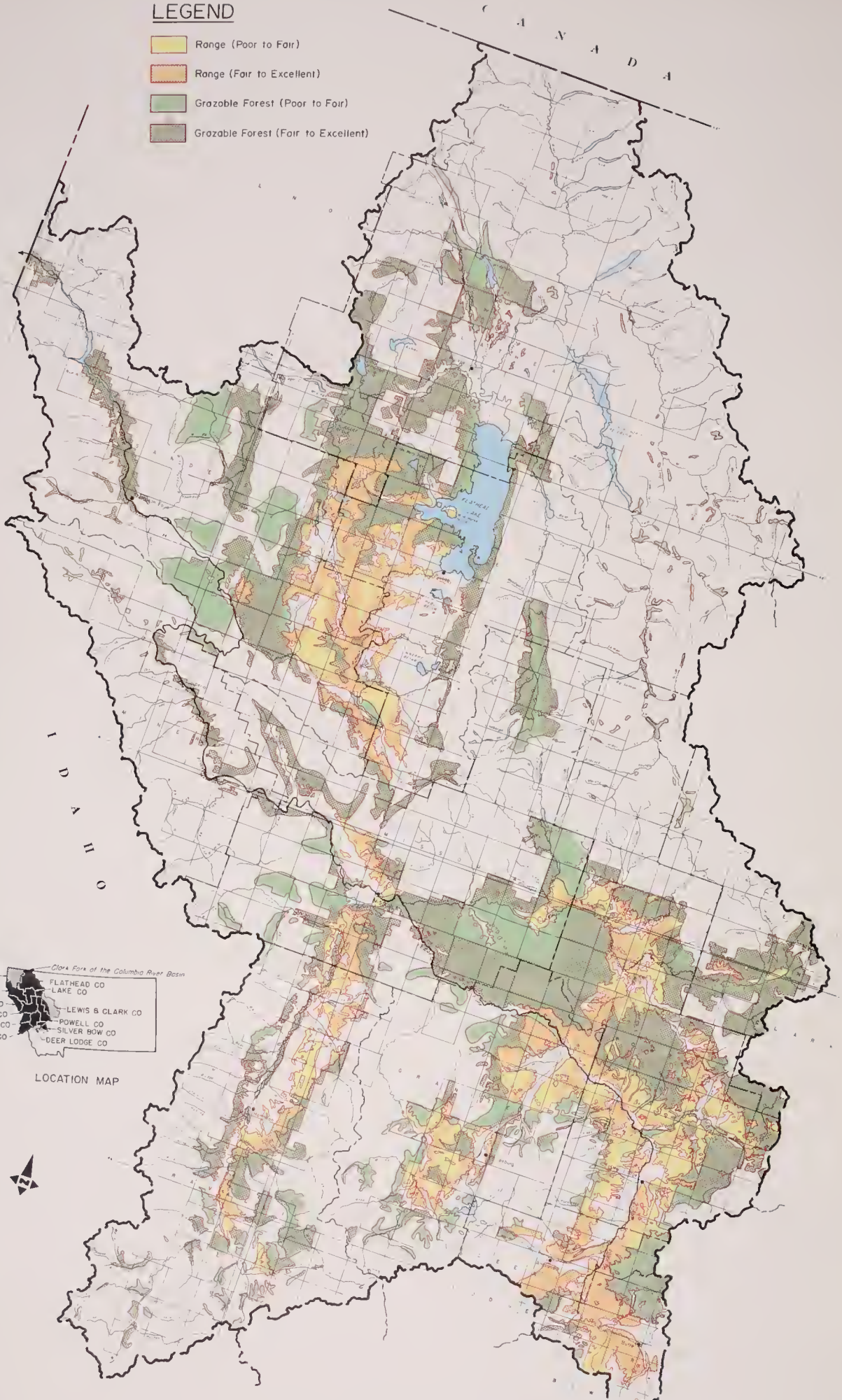
CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

M7-SN-23425-3C



Source
Base map prepared by SCS, Portland Cartog. Unit from AMS 1:250,000 series.
Rangeland data prepared by State Staff.
U.S. DEPARTMENT OF AGRICULTURE

MAP V-10

RANGELAND BY CONDITION

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

M17-SN-23425-30

TABLE V-4--VEGETATIVE COVER GROUPS--ASSOCIATED SPECIES--PHYSICAL FACTORS--RESOURCE USES
CLARK FORK OF THE COLUMBIA RIVER BASIN

Broad Vegetative Group	Rockland-Alpine	Lodgepole-Subalpine	Spruce, Fir-Lodgepole	Douglas-fir-Lodgepole	Larch-Lodgepole	Western White Pine	Ponderosa Pine	Wheatgrass-fescue	Grassland-Shrub
Vegetative Type	Principal Associated Species								
Trees	NA	Alpine fir Engelman spruce Whitebark pine Mtn. hemlock Lodgepole pine	Engelman spruce Subalpine fir Douglas-fir Western larch Lodgepole pine	Western larch Limber pine Engelman spruce Ponderosa pine	Douglas-fir Western white-pine Grand fir Lodgepole pine	Western larch Western red cedar Grand fir	Douglas-fir Lodgepole pine Rocky Mountain Juniper	NA	NA
Shrubs	Summit willow Snow willow Red mountain-heath Western ledum	Red mountain-heath Grouse whortle-berry	Ceanothus Grouse whortle-berry Ninebark	Oregongrape Rose Spiraea Whortleberry Huckleberry	Kinnikinnick Serviceberry Spiraea Snowberry	Ceanothus Kinnikinnick Russet buffalo-berry	Snowberry Ninebark Oregongrape Rose	Willows Shrubby cinque-foil Skunkbush sumac Rabbitbrush	Mountain mahogony Bitterbrush Big sagebrush Rabbitbrush Sagewort
Grasses and Grasslike	Sedge Alpine timothy Alpine blue-grass Sheep fescue	Richardsons needlegrass Idaho fescue Elk sedge Mountain brome	Bluegrass Pinegrass Elk Sedge	Pine reedgrass Sedge Bluegrass	Pine reedgrass Sedge Little ricegrass	Elk sedge Pinegrass	Rough fescue Bluebunch wheatgrass Idaho fescue Western wheatgrass	Bluebunch wheatgrass Rough fescue Idaho fescue Columbia needle-grass	Idaho fescue Threadleaf sedge Wheatgrass Needleandthread
Forbs	Clubmoss Lupine Bluebell Alpine forgetmenot	Arnica Aster Lupine Beargrass	Aster Beargrass Indianpaintbrush Fleabane	Arnica False solomons-seal Showy aster	Arnica Beargrass Glacier lily	Lupine Arnica	Arrowleaf balsamroot Lupine Buttercup	Lupine Yarrow Arrowleaf balsam-root	Phlox Rose pussytoes Lupine
Physical Factors:									
Topography	Above timberline	Rough mountains	Mountains--valley bottoms	Mountains	Mountains--valley bottoms	Mountains	Foothills and benches	Rolling hills-plains	Undulating uplands
Elevation range (ft.) (above mean sea level)	6000-10,665	3500-9500	3000-9000	3000-7900	3000-7000	3000-6100	3300-6000	3000-6000	3000-5500
Precipitation zone	50"-120"	20"-100"	40"-100"	18"-30"	20"-50"	40"-70"	10"-30"	10"-19"	10"-14"
Soils	Rocky Shallow	Sandy loams Rocky	Young loam Alluvial Gravels	Loam Sand Gravel	Sandy loams Clay	Silty loam Clay loam	All loams Loamy sands Gravel	All loams & clays Shallows and stoney	Rocky to gravelly loams
Resource Uses	Recreation Wildlife Watershed	Recreation Wildlife Timber Watershed	Watershed Wildlife Recreation Timber	Timber Watershed Wildlife Recreation Grazed woodlands	Timber Watershed Wildlife Recreation Grazed woodlands	Timber Watershed Wildlife Recreation	Wildlife Timber Recreation Grazed woodland Watershed	Agriculture Range Wildlife Recreation	Range Wildlife

Source River Basin Planning Staff

TABLE V-5--MAJOR TYPES OF LAND OWNERSHIP IN THE TEN-COUNTY AREA
CLARK FORK OF THE COLUMBIA RIVER BASIN

Subarea and County	Total Area in County 1/	Land Area in County 2/	Federal Lands			State and Private Lands			
			National Forest 3/	Other Federal 3/	Total Federal	State-owned 3/	Indian Nontaxable 4/	Other Private	Total State and Private
	- - - - - -	- - - - - -	- - - - - -	- - - - - -	acres	- - - - - -	- - - - - -	- - - - - -	- - - - - -
UPPER CLARK FORK									
Deer Lodge	474,240	472,910	151,870	5,850	157,720	55,370	0	259,820	315,190
Granite	1,111,680	1,108,080	660,990	46,630	707,620	18,170	0	382,290	400,460
Powell	1,497,600	1,487,230	644,190	78,050	722,240	96,920	0	668,070	764,990
Silver Bow	458,240	457,380	192,730	44,050	236,780	27,030	0	193,570	220,600
TOTAL	3,541,760	3,525,600	1,649,780	174,580	1,824,360	197,490	0	1,503,750	1,701,240
LOWER CLARK FORK									
Mineral	782,720	779,820	646,890	0	646,890	21,960	0	110,970	132,930
Missoula	1,679,360	1,666,560	677,990	25,440	703,430	93,680	94,390	775,060	963,130
Ravalli	1,528,320	1,518,560	1,109,520	2,730	1,112,250	38,960	0	367,350	406,310
Sanders	1,804,160	1,771,190	912,260	9,850	922,110	62,960	226,390	559,730	849,080
TOTAL	5,794,560	5,736,130	3,346,660	38,020	3,384,680	217,560	320,780	1,813,110	2,351,450
FLATHEAD									
Flathead	3,379,200	3,281,030	1,794,540	618,960	2,413,500	133,570	7,770	726,190	867,530
Lake	1,059,200	951,220	163,000	10,610	173,610	62,960	288,210	426,440	777,610
TOTAL	4,438,400	4,232,250	1,957,540	629,570	2,587,110	196,530	295,980	1,152,630	1,645,140
TEN-COUNTY TOTAL	13,774,720	13,493,980	6,953,980	842,170	7,796,150	611,580	616,760	4,469,490	5,697,830

1/ Areas of Montana, 1960: Bureau of the Census Report GE20, No. 28, December 1964
2/ Large inland water areas from reference 1/above; small water areas from Montana Soil and Water Conservation Needs, Soil Conservation Service, 1970
3/ Tabulation of land ownership from State Lands Office, June 1976; letters to David Ricks from University System and Department of Institutions; and personal inquiry for DOD ownership on old Fort Missoula.
4/ Data provided by James O. Jackson, Chief, Real Property Management, BIA, Billings, September 1976

TABLE V-6--MAJOR LAND USES IN THE TEN-COUNTY AREA

CLARK FORK OF THE COLUMBIA RIVER BASIN

Subarea and County	Large & Small Water Areas 1/	Land Area 1/	Federal Lands			State and Private Lands						
			Nonforest Rangeland 2/	Forest & Other Land 3/	Total Federal	Forest 2/	Nonforest Rangeland 4/	Irrigated Cropland & Pasture 4/	Nonirrig. Cropland & Pasture 4/	Urban & Built-up 5/	Other Ag. Land 5/	Total State & Private
	acres											
UPPER CLARK FORK												
Deer Lodge	1,330	472,910	16,750	140,970	157,720	119,280	146,857	25,103	2,100	19,950	1,900	315,190
Granite	3,600	1,108,080	21,800	685,820	707,620	158,550	181,844	41,686	9,280	6,200	2,900	400,460
Powell	10,370	1,487,230	11,320	710,920	722,240	278,300	361,697	74,433	30,000	14,110	6,450	764,990
Silver Bow	860	457,380	60,850	175,930	236,780	50,050	142,930	9,100	3,730	13,320	1,470	220,600
TOTAL	16,160	3,525,600	110,720	1,713,640	1,824,360	606,180	833,328	150,322	45,110	53,580	12,720	1,701,240
LOWER CLARK FORK												
Mineral	2,900	779,820	2,140	644,750	646,890	116,310	523	1,637	3,880	9,240	1,340	132,930
Missoula	12,800	1,666,560	18,070	685,360	703,430	804,760	73,747	31,083	23,100	18,000	12,440	963,130
Ravalli	9,760	1,518,560	12,740	1,099,510	1,112,250	163,020	94,927	114,003	15,700	7,780	10,880	406,310
Sanders	32,970	1,771,190	2,760	919,350	922,110	498,660	250,852	24,048	51,600	14,230	9,690	849,080
TOTAL	58,430	5,736,130	35,710	3,348,970	3,384,680	1,582,750	420,049	170,771	94,280	49,250	34,350	2,351,450
FLATHEAD												
Flathead	98,170	3,281,030	9,650	2,403,850	2,413,500	660,950	49,760	25,660	104,700	17,350	9,110	867,530
Lake	107,980	951,220	1,600	172,010	173,610	377,500	180,493	105,877	82,560	19,120	12,060	777,610
TOTAL	206,150	4,232,250	11,250	2,575,860	2,587,110	1,038,450	230,253	131,537	187,260	36,470	21,170	1,645,140
TEN-COUNTY TOTAL	280,740	13,493,980	157,680	7,638,470	7,796,150	3,227,380	1,483,630	452,630	326,650	139,300	68,240	5,697,830

1/ Areas of Montana, 1960; Report GE-20, No. 28, Bureau of the Census, 1964 and 5/ below.
2/ Basin Study Team estimates
3/ Tabulation of land ownership from Montana State Lands Office less Federal Rangeland.
4/ Computations from 1972 Soil Resource Groups Study and 5/ below.
5/ Montana Soil and Water Conservation Needs, SCS, 1970

Forested Lands

The primary land use in the basin is forest. About 10,404,000 acres or about 76 percent of the basin is considered forest land. See table V-7.

Forest lands are defined as those normally having at least 10 percent canopy cover of trees.

Commercial forest land is defined as that which can produce 20 cubic feet or more of wood per year. As shown in table V-7, about 58 percent of the ten-county land area is commercial forest land. See map V-11.

TABLE V-7--LAND AREA BY FOREST LAND CLASS--TEN-COUNTY STUDY AREA CLARK FORK OF THE COLUMBIA RIVER BASIN

Land Class	Thousand Acres
Commercial forest land 1/	7,823
Unregulated	36
Deferred 2/	100
Noncommercial forest land:	
Unproductive-nonreserved	833
Productive-reserved 3/	863
Unproductive-reserved	749
Total forest land	10,404
Nonforest land	3,090
Total land area	13,494

Source: Forest Survey 1970

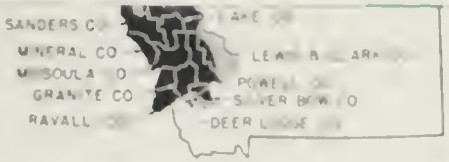
1/ Includes all areas presently or prospectively suitable and available for timber growing, including productive areas currently inoperable or inaccessible but not in wilderness or potential wilderness areas.

2/ Areas deferred pending study to determine appropriate land use. Since 1970 about 2,297,000 acres of commercial and noncommercial national forest land have been designated as roadless areas. About 1,387,000 acres of this are commercial forest.

3/ Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization because of (a) legal withdrawals, (b) administrative withdrawals such as forested administrative sites, natural areas, lands not available for timber production because of conflicts for nontimber uses.

LEGEND

FOREST PRODUCTIVITY



LOCATION MAP

MAP V 11

COMMERCIAL AND NONCOMMERCIAL FORESTS

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

0 10 20 MILES

Forested Lands

The primary land use in the basin is forest. About 10,404,000 acres or about 76 percent of the basin is considered forest land. See table V-7.

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Commercial forest land is defined as that which can produce 20 cubic feet or more of wood per year. As shown in table V-7, about 58 percent of the ten-county land area is commercial forest land. See map V-11.

TABLE V-7--LAND AREA BY FOREST LAND CLASS--TEN-COUNTY STUDY AREA
CLARK FORK OF THE COLUMBIA RIVER BASIN

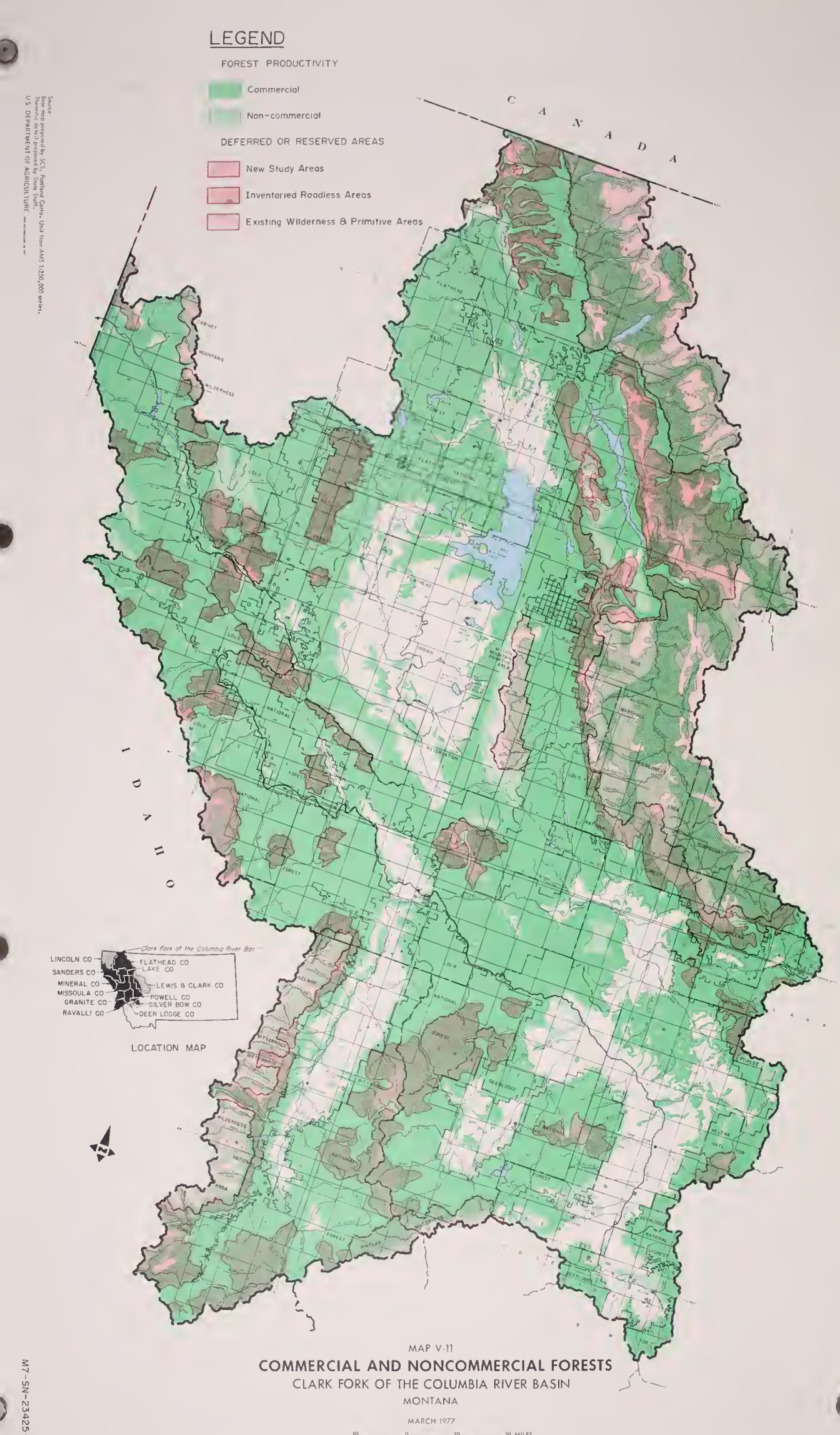
Land Class	Thousand Acres
Commercial forest land 1/	7,823
Unregulated	36
Deferred 2/	100
Noncommercial forest land:	
Unproductive-nonreserved	833
Productive-reserved 3/	863
Unproductive-reserved	749
Total forest land	10,404
Nonforest land	3,090
Total land area	13,494

Source: Forest Survey 1970

1/ Includes all areas presently or prospectively suitable and available for timber growing, including productive areas currently inoperable or inaccessible but not in wilderness or potential wilderness areas.

2/ Areas deferred pending study to determine appropriate land use. Since 1970 about 2,297,000 acres of commercial and noncommercial national forest land have been designated as roadless areas. About 1,387,000 acres of this are commercial forest.

3/ Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization because of (a) legal withdrawals, (b) administrative withdrawals such as forested administrative sites, natural areas, lands not available for timber production because of conflicts for nontimber uses.



MAP V-11

COMMERCIAL AND NONCOMMERCIAL FORESTS

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

SCALE 1:1,000,000

M7-SN-23425-20

Ease of harvest and environmental constraints are not considered when defining the area of commercial forest land. Therefore, some of the forest classed as commercial is not available for harvest. Trees around campgrounds and homes are generally cut only when they become dangerous. Trees on very steep slopes are hard to reach and should remain to protect the slopes from erosion. Some tree-covered areas on National Forests will be left uncut to protect scenic areas.

Of the 1970 commercial timber base, only 48 percent of it is capable of growing in excess of 85 cubic feet of industrial wood per acre per year. It is on this portion of the timber growing base that financial returns to management are high enough to attract investment capital. On the other 52 percent of the timber growing base, the rate of return is less attractive and the land cannot economically receive intensive management until such time that the projected value for wood increases or there are technological innovations in management, manufacturing, or marketing of timber products.

Thirty percent of the commercial timber growing base is in private ownership consisting of forest industries, farmers, and miscellaneous private entities. Only 11 percent of these private commercial forests have the capacity to grow more than 85 cubic feet of wood per year as shown in table V-8.

TABLE V-8--COMMERCIAL FOREST LAND BY OWNERSHIP GROUP AND PRODUCTIVITY CLASS 1/--TEN-COUNTY STUDY AREA
CLARK FORK OF THE COLUMBIA RIVER BASIN

Productivity Class 2/	All Ownerships	National Forest	Other Public	Forest Industry	Farmer and Miscellaneous Private
Cu.ft./Ac./Yr.	- - - - - - - - - - Thousand acres - - - - - - - - - -				
120'+	1,260	1,188	19	21	32
85'-119'	2,468	2,195	75	86	112
50'-84'	1,955	597	383	322	653
20'-49'	2,140	601	457	286	796
All classes	7,823	4,581	934	715	1,593

Source: USDA Forest Resource Bulletin INT10, 1970, by Alan W. Green and Theodore S. Setzer, Table 16, adjusted to represent study area.

1/ The classification of forest land in terms of inherent capacity to grow crops of industrial wood.

2/ Growth in cubic feet per acre per year on all trees 4.0 inches or larger in diameter in fully stocked stands at culmination of mean annual growth.

Thirty percent of the commercial forest land is controlled by more than 8,000 private owners. However, as few as 250 owners control 72 percent of the private timber base. About half of private owners control less than 40 acres each and together they own only three percent of the private timber base. These relationships are shown in table V-9.

TABLE V-9--OWNERSHIP OF PRIVATE COMMERCIAL FOREST LAND BY SIZE OF OWNERSHIP--TEN-COUNTY STUDY AREA
CLARK FORK OF THE COLUMBIA RIVER BASIN

Size of Ownership (Acres)	Owners		Acreage Owned	
	Number	Percent	Thousands	Percent
0 to 39	4,489	51.3	70	3.0
40 to 159	2,845	32.5	234	10.1
160 to 639	1,178	13.4	347	15.1
640+	247	2.8	1,657	71.8
All sizes	8,759	100.0	2,308	100.0

Based on Montana Forest Fire Protection Assessment Rolls--1970

Other lands

The third largest land use (over 652,000 acres) is in alpine areas, roads, and other areas not in agricultural or forest production. The largest part of this is alpine areas in national park or wilderness areas. These are very scenic areas which are covered most of the year by snow and ice. This area includes some, but not all, of the subdivided areas in the basin. Forest roads are particularly susceptible to erosion.

Irrigated lands

Irrigated cropland and pasture include about 452,630 acres or three percent of the ten-county area. About 208,000 acres have some late-season water shortages, particularly in dry years. About 193,000 acres already have sprinkler irrigation systems in operation; 168,000 of these acres were installed with SCS assistance. Map V-12 shows locations of most irrigated and irrigable lands in the basin. About 109,800 acres of the irrigated croplands are in type I and type II wetlands.


LOCATION MAP
MAP V 12
IRRIGATED AND DRY CROPLAND
AND IRRIGABLE LANDS
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10 0 10 20 MILES

M7-SN-23425-8

Thirty percent of the commercial forest land is controlled by more than 8,000 private owners. However, as few as 250 owners control 72 percent of the private timber base. About half of private owners control less than 40 acres each and together they own only three percent of the private timber base. These relationships are shown in table V-9.

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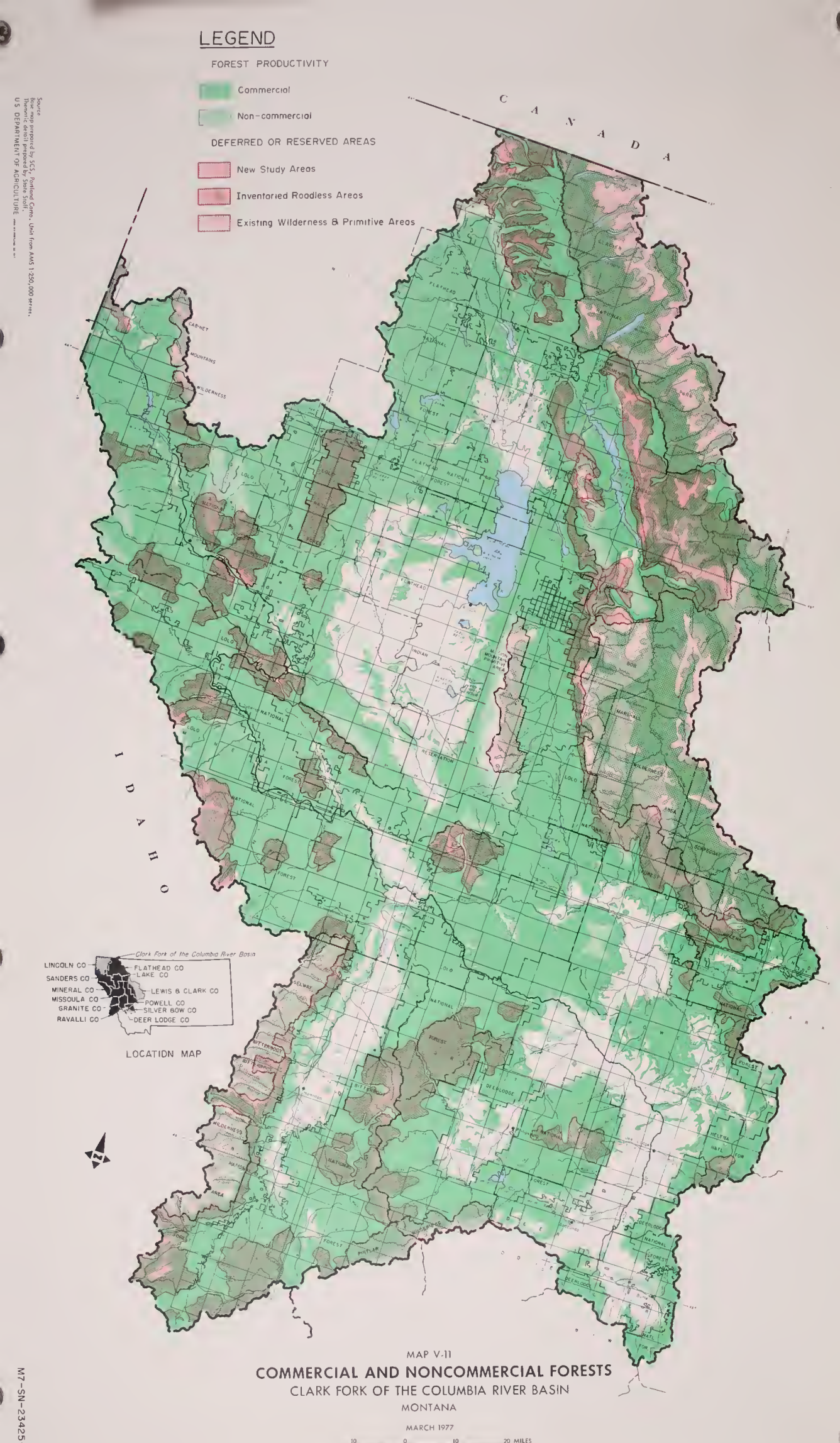

LEGEND
FOREST PRODUCTIVITY
Commercial
Non-commercial
DEFERRED OR RESERVED AREAS
New Study Areas
Inventoried Roadless Areas
Existing Wilderness & Primitive Areas
CANADA
IDAHO
Clark Fork of the Columbia River Basin
LINCOLN CO
SANDERS CO
MINERAL CO
MISSOULA CO
GRANITE CO
RAVALLI CO
FLATHEAD CO
LAKE CO
LEWIS & CLARK CO
POWELL CO
SILVER BOW CO
DEER LODGE CO
LOCATION MAP
Source
Base map prepared by SCS, Portland Comm. Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.
U.S. DEPARTMENT OF AGRICULTURE
MAP V-11
COMMERCIAL AND NONCOMMERCIAL FORESTS
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10 0 10 20 MILES
SCALE 1:1,000,000
M7-SN-23425-20

Nonirrigated lands

Nonirrigated croplands and dry pastures are on about 355,000 acres or 2.8 percent of the area. Their general locations can be seen on map V-9. These lands are not as productive as irrigated lands, but production costs are much lower. Some of these lands are also identified as types I and II wetlands and benefit to a certain degree from subirrigation.

Subdivided land

Some of the private land now listed as crop, pasture, range, or forest land has been subdivided. Data from the Environmental Information center, a private organization that conducted intensive research on the subject, indicates that about 179,000 acres of land in the basin have been subdivided. This represents about 3.5 percent of the Indian and other private land in the ten-county area.

Data on rates of subdivision are available only for Ravalli County before 1958. Sketchy data are available for Flathead and Missoula Counties for recent years. Since 1967 the estimated subdivided area in these three counties has increased from about 84,500 acres to about 148,000 in 1974 and perhaps as much as 185,000 in 1976. This represents about 9.4 percent of the Indian and other private land in these three counties. Lake County also has a rather high rate of subdivision. All the other counties are being affected by subdivision to a much lesser extent. The evidence indicates that the rate of subdivision is increasing and directly affects all types of land use not in federal or state ownership.

Potentials for land use

Land uses in this basin are limited by topography; climate; federal, state, and Indian tribal ownership; wilderness areas; Glacier National Park; and wildlife refuges. Most of the practical shifts from forest and range to cropland and pasture have already taken place.

The land now in commercial forest has the potential for improved forest production. The climatic limitations severely restrain agricultural yield rates, but some lands near Flathead Lake are uniquely suited to cherry production. The Mission valley is important for disease-free seed potato production. The basin is an attractive area for summer home sites. Most of the private land not on flood plains, steep slopes, or wetland has suitable soils for such development.

The greatest potential for increased agricultural production involves the conversion of areas under conventional surface irrigation to sprinkler irrigation. However, some potential exists for producing current and increased crops and forage with less cost with less irrigation. Yield rates would be less stable from year to year on lands where irrigation is not practiced.

Some lands not now irrigated have potential for irrigation as based on topography and soils information. Such lands have been identified by Montana Department of Natural Resources and Conservation. No attempt was made during the initial inventory stage to determine the economic costs or benefits involved with irrigating these areas. Most of the areas are so far away from or so high above suitable water sources as to be uneconomical to irrigate in the near future. Many of these areas were evaluated under watershed investigation analyses. See map X-1. Most of the land that is feasible to irrigate by small watershed project development is already irrigated. Some of the identified irrigable areas are within national forest or national park boundaries. Due to their location, these lands should not be considered as part of the irrigable base. Data about physically irrigable lands are listed in table V-10 and shown on map V-12.

Wildlife populations can be preserved and enhanced by protecting some of the land for wildlife habitat. Winter ranges are particularly important for elk and deer. Frequently, these range areas are also attractive for livestock grazing or for recreation-type homesites. These three uses are not generally compatible in these areas.

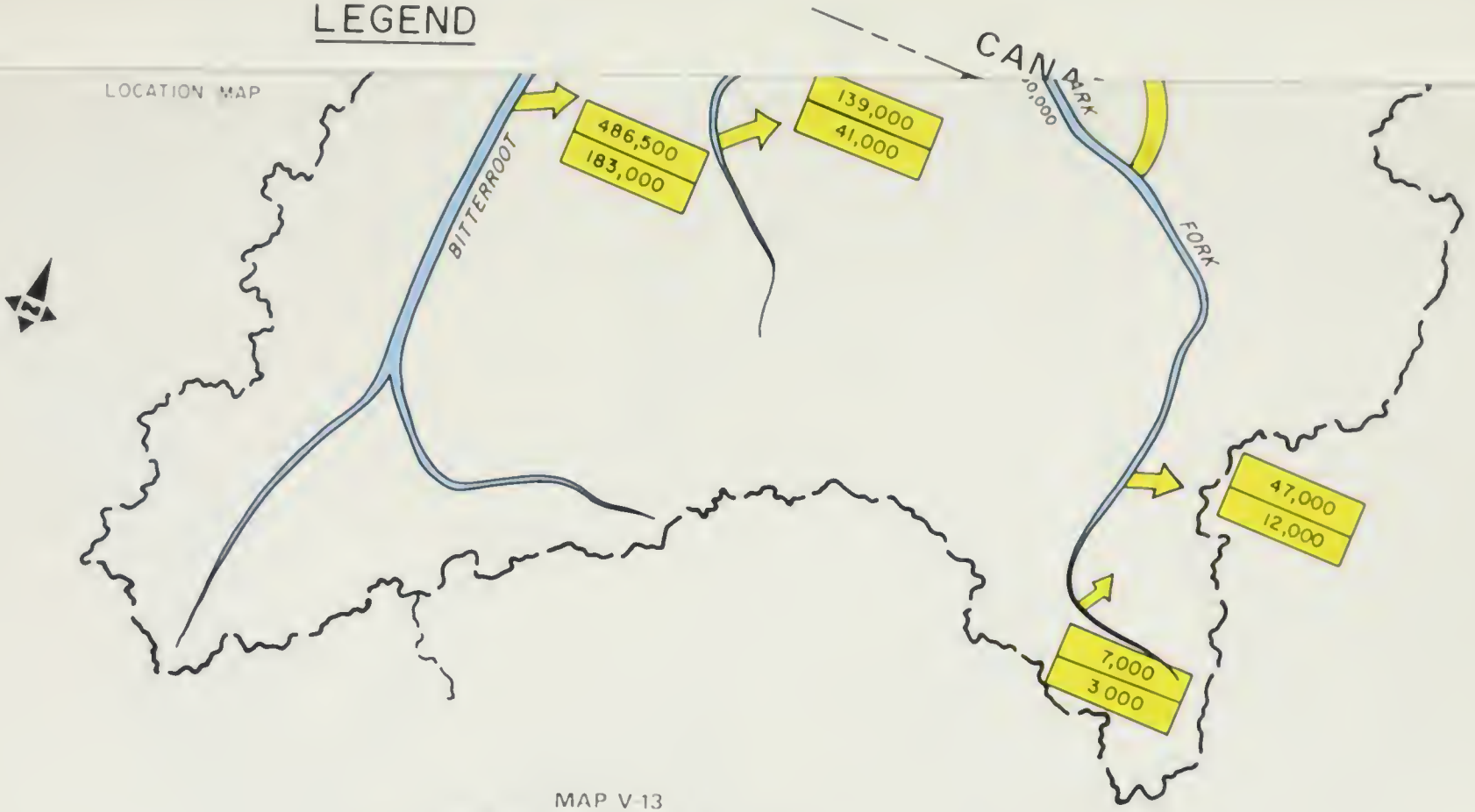
While this basin is not under a major waterfowl flyway, there is potential to preserve and enhance waterfowl populations. Streams, lakes, potholes, marshes, and associated wetlands are particularly important nesting, resting, and food source areas for waterfowl. Some of these areas are now in wildlife refuges and more could be. The National Bison Range is well suited for the preservation of its herd of bison and the other wildlife resident there.

WATER RESOURCES

Surface Water

Average annual discharge from the basin for the 1928-1975 period was 16,265,000 acre-feet. Inflow from Canada contributed about 719,400 acre-feet for an average net annual basin runoff of 15,545,600 acre-feet. Total basin precipitation is estimated to average about 32,820,000 acre-feet, including evaporation from water surfaces, 670,000 acre-feet; total evapotranspiration from irrigated crops, about 600,000 acre-feet; evapotranspiration from other vegetative areas, estimated at 16,000,000 acre-feet; and the basin runoff. Total irrigation diversions from streams average about 1,644,600 acre-feet with a diversion shortage of about 340,600 acre-feet at present project efficiencies. Average annual streamflows are shown on map V-13.

In perspective, the basin has a tremendous annual gross surplus of water. However, there are seasonal shortages of water for agricultural and aquatic wildlife uses. These temporal shortages may be overcome with storage of early-season runoff for late-season use where there are physically and economically feasible storage sites that are environmentally acceptable and have sufficient total annual streamflows. There are numerous small



MAP V-13

WATER FLOW CHART
ANNUAL YIELD AND DEPLETIONS
IN ACRE FEET

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

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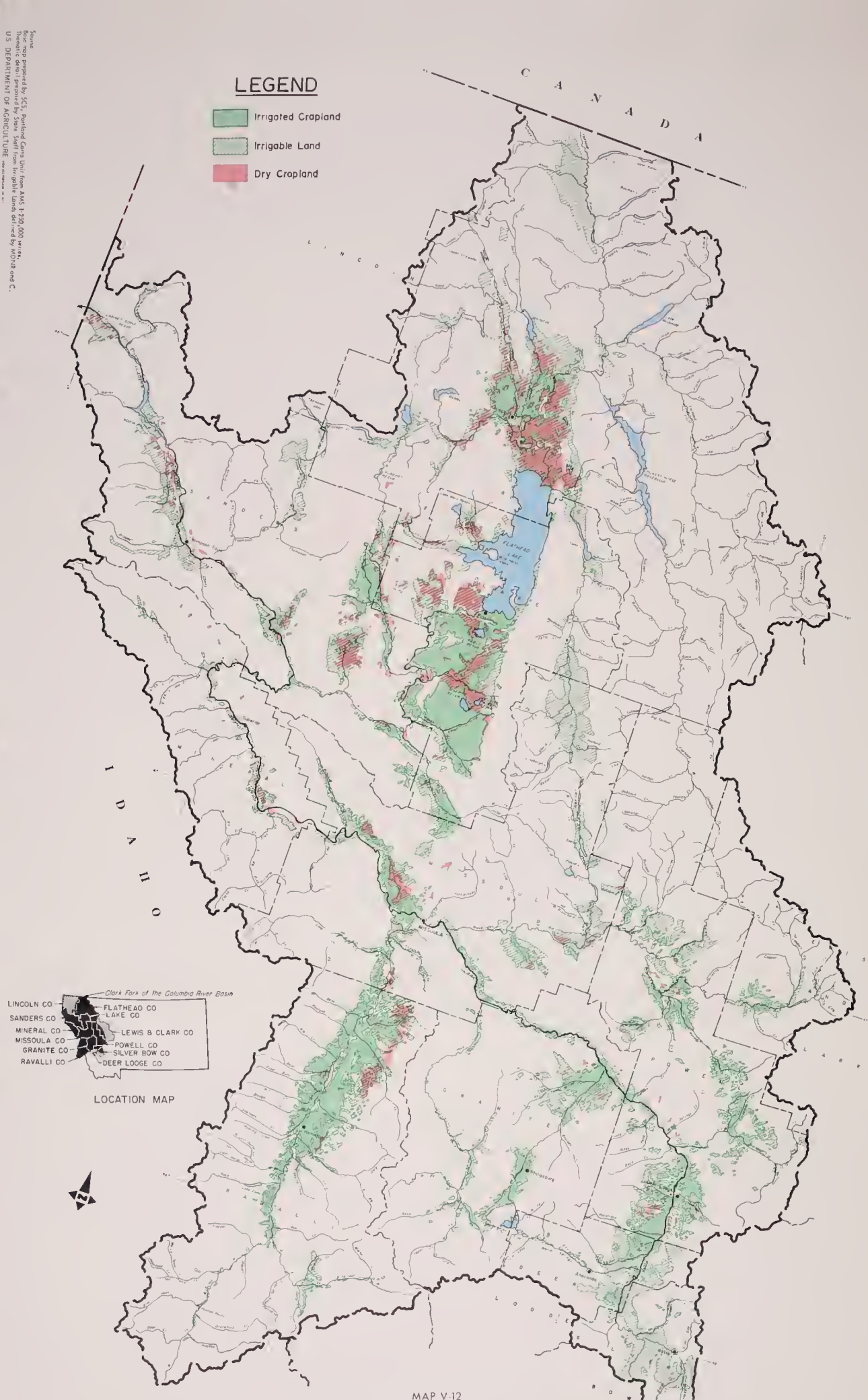


Source
Base map prepared by SCS, Portland Cartographic Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff from Irrigable Lands defined by MDNR and C.
U.S. DEPARTMENT OF AGRICULTURE

MAP V-12

IRRIGATED AND DRY CROPLAND AND IRRIGABLE LANDS

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

SCALE 1:1,000,000

M7-SN-23425-B

TABLE V-10--PHYSICALLY IRRIGABLE AREAS

CLARK FORK OF THE COLUMBIA RIVER BASIN

SUBBASIN AND COUNTY	ACRES
UPPER CLARK FORK	
Deer Lodge	63,000
Granite	62,000
Powell	122,000
Silver Bow	63,000
Lewis & Clark	15,000
Subtotal	325,000
LOWER CLARK FORK	
Mineral	22,000
Missoula	172,000
Ravalli	58,000
Sanders	182,000
Subtotal	434,000
FLATHEAD	
Flathead	263,000
Lake	180,000
Lincoln	2,000
Subtotal	445,000
BASIN TOTAL	1,204,000

Source: Montana Department of Natural Resources and Conservation

reservoirs in the basin. Table V-11 lists the existing large reservoirs in the basin. From this table it can be seen that irrigation storage is only about six percent of the total storage. Economically feasible sites for irrigation storage are not numerous.

Ground Water

Although ground water is often considered as a separate resource in terms of its location, problems, and quality, it is actually just a part of the overall water yield. All water in the basin arrives as precipitation or inflow from Canada and leaves the basin by evaporation, streamflow, or ground-water flow. An examination of the topography and geology of the basin indicates that the exit of water from the basin through subsurface flow is relatively minor. However, ground-water flows and storages in aquifers within the basin are a very important part of the basin's water supply.

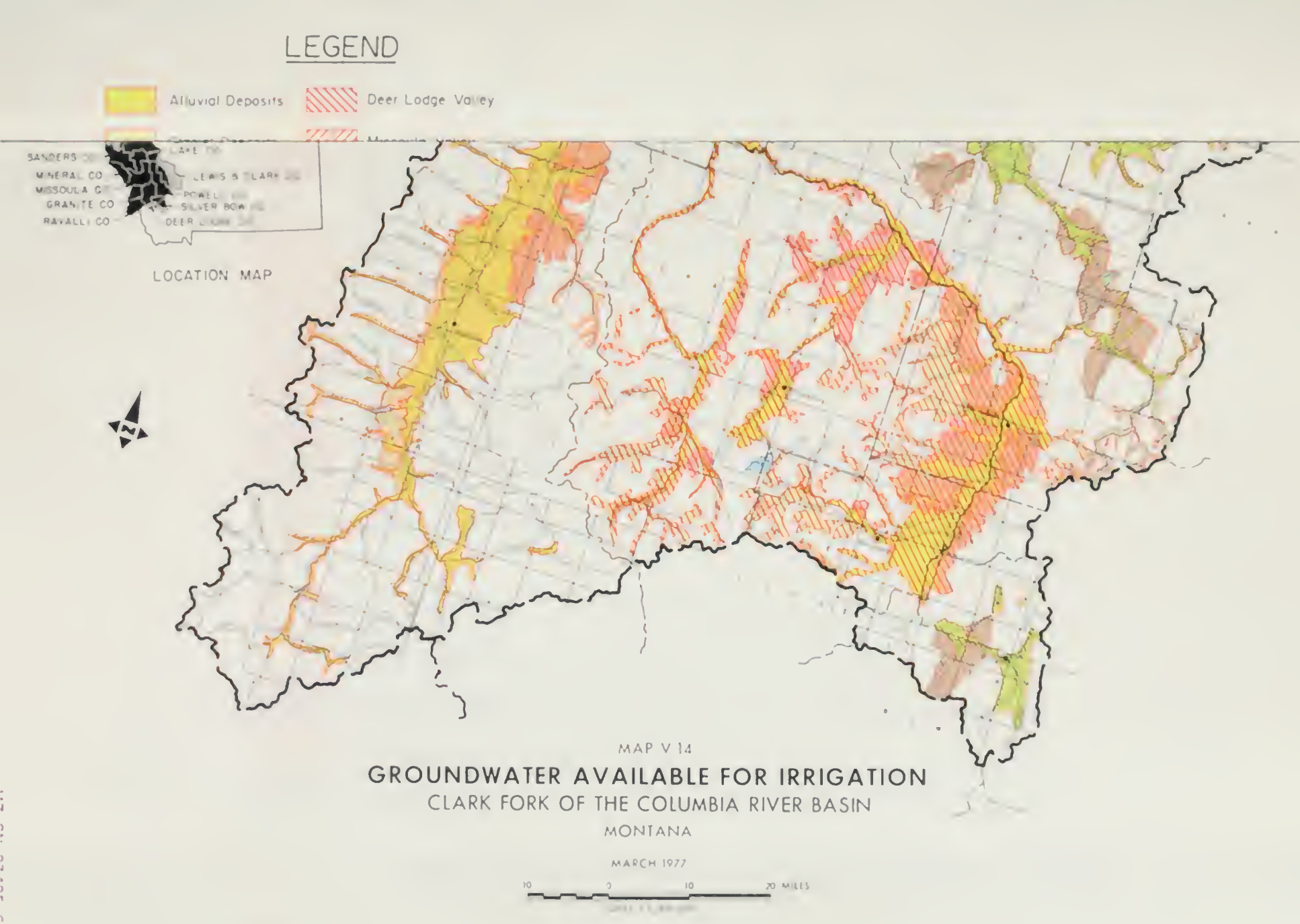
Ground water quality is often affected by the duration of contact with soluble minerals or by deep percolation of waters contaminated by agricultural chemicals or sewage effluents. In general, deeper wells are less apt to be contaminated from surface sources than are shallow wells, but are more apt to contain undesirable salts. Because deeper ground water is less apt to have coliform contamination than is surface water, the Montana Department of Health and Environmental Sciences is actively encouraging towns and communities to develop potable supplies from ground water.

Most of the ground-water supplies are of good enough quality for irrigation, livestock, and domestic use. At the present time, ground-water recharge far exceeds withdrawals in the basin.

Ground-water potential for irrigation

In some areas, ground-water aquifers carry water in sufficient quantities that irrigation wells can be developed without measurably affecting elevations of the water table. Ground-water supplies, depths to water, and expected yields are shown on map V-14.

For high-producing wells of moderate depth, the important aquifers are the thick alluvial deposits along the major valley floors, glacial outwash deposits, and tertiary sediments which contain sand and gravel channels. The amount of water in an aquifer depends on its porosity and its permeability or its ability to transmit or yield water. A high-yielding aquifer will have high porosity and permeability. Most of the hard bedrock in this basin is low in permeability and porosity and cannot supply the high yields needed for irrigation supply.


LEGEND
Alluvial Deposits
Deer Lodge Valley
SANDERS CO
MINERAL CO
MISSOULA CO
GRANITE CO
RAVALLI CO
LAKE CO
LEWIS & CLARK CO
POWELL CO
SILVER BOW CO
DEER LODGE CO
LOCATION MAP
MAP V 14
GROUNDWATER AVAILABLE FOR IRRIGATION
CLARK FORK OF THE COLUMBIA RIVER BASIN
MONTANA
MARCH 1977
10 0 10 20 MILES

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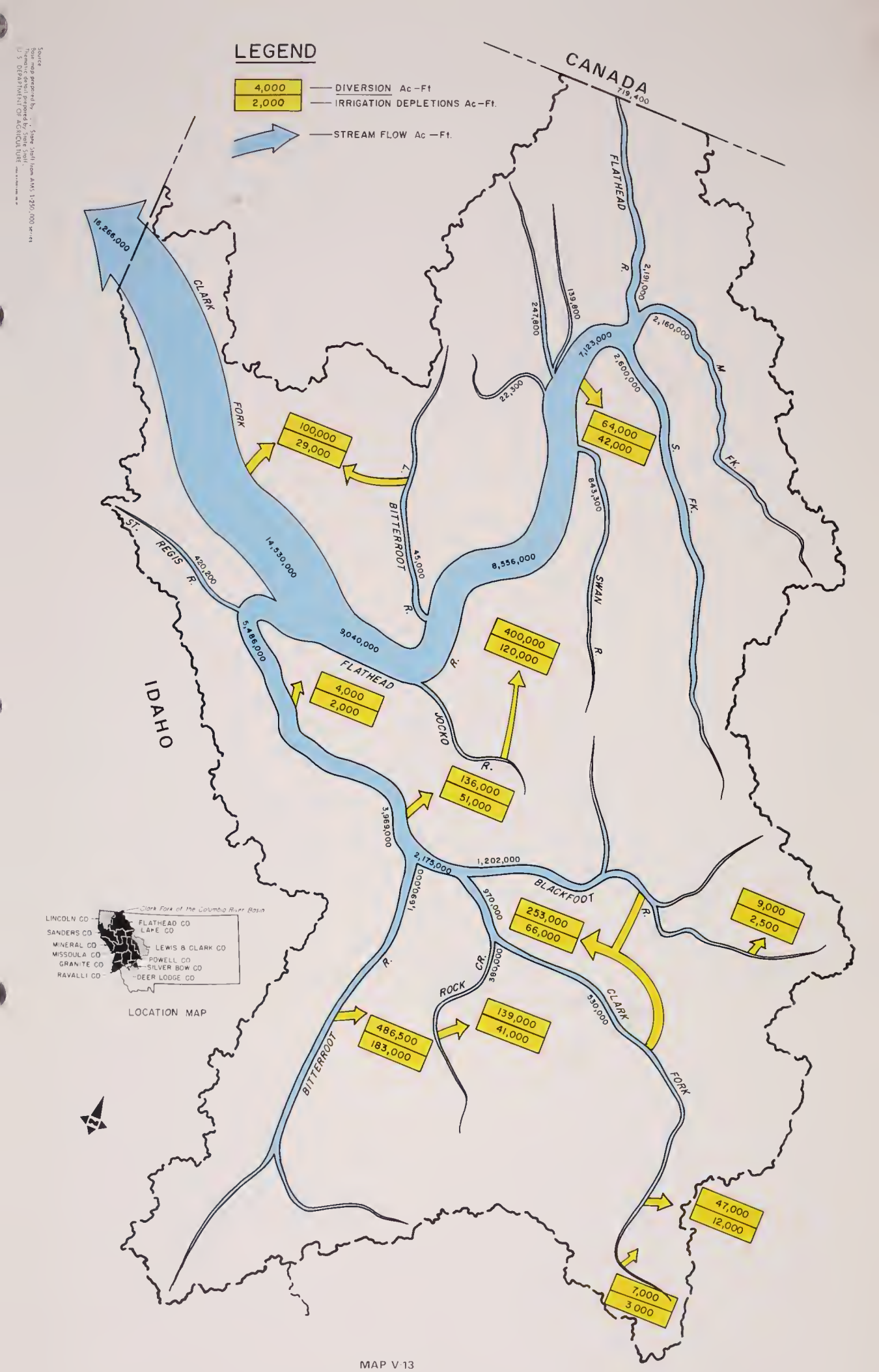


MAP V-13

WATER FLOW CHART
ANNUAL YIELD AND DEPLETIONS
IN ACRE FEET

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

SCALE 1:1,000,000

M7-N-23425-31

GROUNDWATER AVAILABLE FOR IRRIGATION

GLACIAL DEPOSITS -- Contains outwash gravels that are very permeable. Deposits are over 600 feet thick. High producing wells from upper free water zones and from two deep artesian aquifers. Water table wells range from 20 to 150 feet in depth - yields range from 1000 to 1500 gpm. Deep artesian aquifers 300 to 500 feet in depth, over 256 feet thick - yields up to 250 gpm. in natural flow. Can yield over 2500 gpm. when pumped - large recharge area. Shallow artesian aquifer approximately 60 feet thick, occurs along the east side of the Flathead River from an area south of Creston to an area just south of Columbia Falls. Cemented gravel approximately 40 feet thick, seperates this shallow artesian aquifer from the high yielding deep artesian zone. Average depth to the top of the shallow artesian zone is 100 feet. Well at the fish hatchery in Creston is 300 feet deep. It flows 195 gpm. and is pumped at 750 gpm. Wells at the Anaconda Aluminum Plant also penetrates the deep artesian aquifer.

TERTIARY DEPOSITS -- Over 600 feet thick - yields range from 100 to 250 gpm. Depth to water generally over 100 feet.

LINCOLN–CLEARWATER AREA

ALLUVIAL DEPOSITS -- 25 to 75 feet thick - maximum yield 800 gpm. Depth to water generally less than 25 feet.

GLACIAL DEPOSITS -- Over 300 feet thick - yields from 10 to 300 gpm. Depth to water generally less than 50 feet.

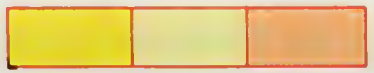
TERTIARY DEPOSITS -- 0 to over 800 feet in thickness - potential yield up to 1000 gpm. Depth to groundwater generally more than 150 feet.

BUTTE VALLEY

ALLUVIAL DEPOSITS -- 50 to over 600 feet thick - yields range from 50 to 400 gpm.

TERTIARY DEPOSITS -- Over 500 feet in depth - yields range from 15 to 75 gpm.

HIGH MOUNTAIN VALLEYS



No developed sub-surface irrigation supply.

TABLE V-11--RESERVOIRS HAVING TOTAL CAPACITY OF 5,000 ACRE-FEET OR MORE

CLARK FORK OF THE COLUMBIA RIVER BASIN

Name	Stream	Total Storage (acre-feet)	Active Storage (acre-feet)	Main* Purpose	Surface Area (acres)
Ashley Lake	Ashley Lake	20,000	20,000	I	3,000
Cabinet Gorge	Clark Fork R.	112,000	42,000	P	3,230
Como Lake	Rock Cr.	36,690	34,900	I	940
Flathead Lake	Flathead R.	1,791,000	1,219,000	P	126,000
E.F. Rock Creek	E.F. Rock Cr.	16,040	16,000	I	440
Georgetown Lake	Flint Cr.	31,040	31,000	P	3,000
Hubbart	L. Bitterroot R.	12,100	12,100	I	460
Hungry Horse	S.F. Flathead R.	3,468,000	2,982,000	P	23,750
Kicking Horse	Crow Cr. (offstream)	8 420	8,350	I	785
L. Bitterroot Lake	L. Bitterroot R.	26,400	26,000	I	2,990
Lower Crow	Crow Cr.	10,350	10,350	I	340
Lower Jocko Lake	M.F. Jocko R.	7,580	6,380	I	115
Lower Willow Creek	Willow Cr.	5,100	4,800	I	170
McDonald	Post Cr.	10,600	8,200	I	200
Mission	Mission Cr.	7,250	7,250	I	290
Nevada Creek	Nevada Cr.	12,640	12,640	I	375
Ninepipe	Flathead R. (offstream)	14,870	14,870	I	1,600
Noxon Rapids	Clark Fork	495,600	334,600	P	7,900
Pablo	Flathead R. (offstream)	29,600	27,100	I	2,040
Painted Rocks Lake	W.F. Bitterroot R.	32,360	31,700	I	655
Tabor (St. Mary Lake)	Dry Cr.	23,300	23,300	I	285
Thompson Falls	Clark Fork	69,400	14,970		1,450
		6,240,340	4,888,310		180,015

Source: Montana Department of Natural Resources and Conservation

*I = Irrigation
P = Power

When ground water is confined to an aquifer between two impervious zones, it may develop artesian pressure. The cost of pumping from an artesian well is less than it might be without the artesian pressure. There are two areas where artesian conditions may be important for irrigation. One is a small area near Hot Springs in the Little Bitterroot River valley. The other is in Flathead County near and south of Columbia Falls.

In the remainder of the basin, the pumping depth depends on the well location and the thickness of the alluvial or glacial deposit above the water table. Most of the large valleys of western Montana are believed to be geologically similar. Generally the flat center portion of the valleys consists of permeable stream-washed gravel and sand underlain by semiconsolidated Tertiary (older) sediments which are usually exposed in terrace and fan areas along the valley margins. Tributary streams flowing from mountain canyons into the main drainage have cut subsidiary valleys in the Tertiary sediments and other formations and supply most of the water to the ground-water-bearing formations. The thickness of the loose, stream-washed alluvial materials may be as much as a few hundred feet in the main valleys and 50 to 100 feet in the tributary valleys. The thickness of the Tertiary sediments may be several hundred feet. Glacial deposits range from 30 to 400 feet in thickness.

Wells in valley centers range from 100 to 300 feet deep. Yields can range from 450 to 2,500 gallons per minute. In the Tertiary sediments, wells range from 200 to 900 feet deep and yield from 50 to 1,500 gallons per minute. Glacial deposits in the northwestern valleys of the basin are excellent aquifers. Wells 30 to 400 feet deep have reported yields of 500 to 3,500 gallons per minute. Wells yielding 200 to 300 gallons per minute or more are required for irrigation of crops.

Ground-water reports for several areas are available from the U. S. Geological Survey or some libraries.

Water Use

Municipal water uses

Public water systems in 50 communities serve 70 percent of the basin population. Nine are served by surface water only; eleven use a combination of surface and ground water; and the remainder use ground water exclusively. Over 57,000 persons are served by ground water and over 86,000 persons use surface water. Total municipal water withdrawal is 54 million gallons per day, or 60,000 acre-feet per year. Water use averages 377 gallons per person per day. About 60 percent of this water returns to the streams. The national average per capita use of water is less than 200 gallons per day. The high rate here is influenced partly by municipal deliveries for lawn and garden irrigation. The average for Montana is about 270 gallons per person per day.

Rural domestic water use

Thirty percent of the basin's residents use private wells as the main source of water for domestic use. As rural use is very difficult to measure, an estimate of 125 gallons per person per day was used to estimate present and future water use in rural areas. The 60,000 rural residents (those not served by municipal systems) of the basin withdraw about 7.5 million gallons per day (8,400 acre-feet per year) of water primarily from ground-water sources.

Livestock water use

Livestock water use in the basin approaches four million gallons per day or 4,300 acre-feet per year. While cattle and pigs are increasing in numbers, milk cows, sheep, and chickens are decreasing. Horse population may also be increasing. Livestock water is estimated to be obtained about equally from surface and ground-water sources.

Self-supplied industrial water use

Industries in the basin supplying their own water (as opposed to those using water from municipal sources) withdraw 26.3 million gallons per day (29,000 acre-feet per year) of ground water and 56 million gallons per day (53,000 acre-feet per year) of surface water for primary metals refining, paper processing, and other uses.

Irrigation water use

There are about 431,700 acres of irrigated land in the hydrologic basin for which about 1.64 million acre-feet of water are diverted, pumped, or stored during the growing season. (There are about 452,630 irrigated acres in the ten-county economic study area.) About 60 percent or 1.0 million acre-feet of this water returns to the streams and subsurface flows.

National forest water uses

Water requirements on the national forests are estimated to total 65 cubic feet per second. Most of these are nonconsumptive uses or are accounted for in the consumptive uses mentioned before.

Water Rights

In 1921 the Montana Supreme Court declared that the Doctrine of Appropriation is the valid Montana water-right law. Montana streams are the property of the state and the appropriator acquires only a right to use the

water and the use must be beneficial. Under the 1973 Montana Water Use Act, beginning on July 1, 1973, all Montana waters--surface, ground, and geothermal--were included in one administrative system under the Montana Water Use Act. At the same time, the Act greatly altered the method of securing the right to use water in the state and provided a centralized water rights filing system in Helena as well as in the county courthouses. A more detailed description of Montana's water right law may be obtained by contacting the Montana Department of Natural Resources and Conservation.

Potentials For Improved Water Supply and Quality

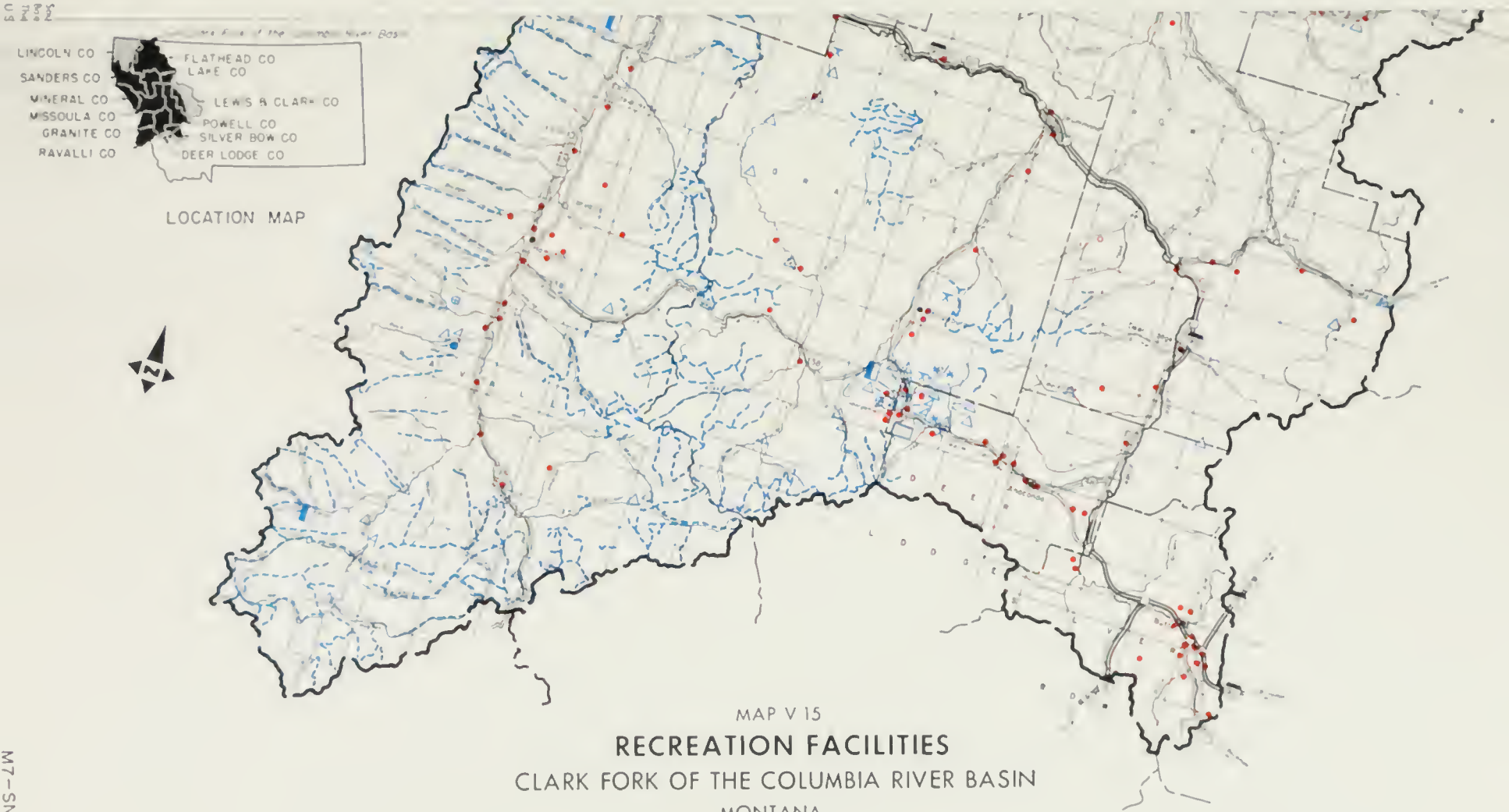
As discussed earlier, the fundamental water problem is one of temporal shortage rather than gross volume shortage of water. This temporal shortage affects late-summer consumptive use and low flow nonconsumptive uses most acutely concerned with water quality. Potentials for solving temporal shortages depend on availability of surplus spring runoff flows and feasible storage sites.

RECREATION FACILITIES AND USE

The real resource for outdoor recreation in the study area is the natural attractiveness of its landscape. Much of this same landscape is simultaneously used to supply food, employment, and income from agricultural or forest production. A portion of the outdoor recreation activity is dispersed and is nonconsumptive. Another portion of the outdoor recreation activity focuses upon localized attractions and requires special attention in the form of management and maintenance. Facilities provided at these localized attraction areas represent an additional economic resource. An inventory of such facility resources is provided in tables V-12, V-13, V-14, and map V-15. The level of participation in outdoor recreation in the study area is estimated to have been near 14 million activity occasions in 1970.

ENERGY SOURCES AND DEVELOPMENT

The primary source of energy in the basin is from hydroelectric dams and associated power transmission lines. The potential for hydroelectric development in the basin is substantial. Table V-15 shows existing hydroelectric plants.



MAP V 15

RECREATION FACILITIES

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

M7-SN-23425-19

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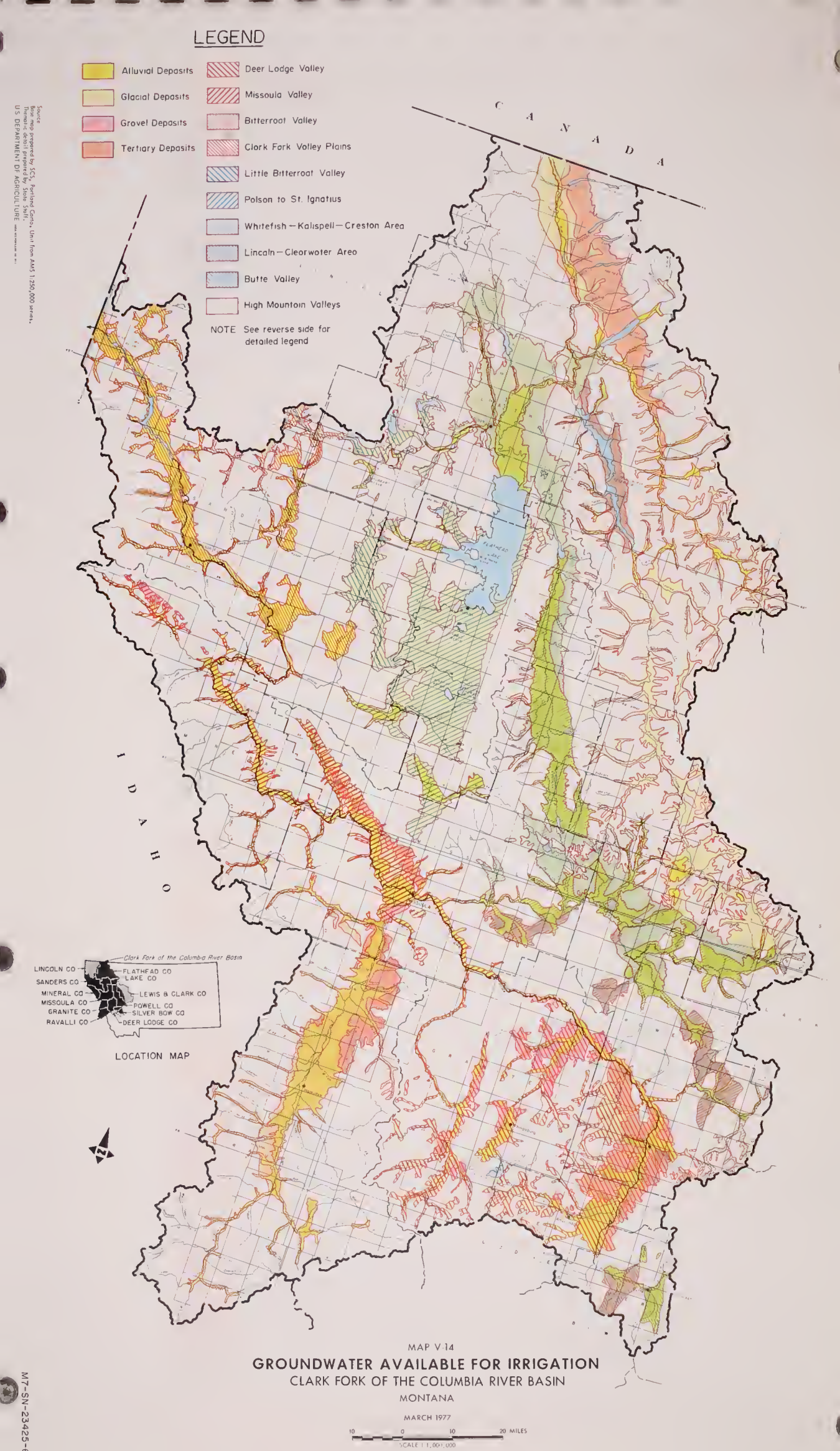


Source
Base map prepared by SCS, Portland Cartog. Unit from AMS 1:250,000 series.
Thematic detail prepared by: Stole Swift.
U.S. DEPARTMENT OF AGRICULTURE

MAP V-14

GROUNDWATER AVAILABLE FOR IRRIGATION

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

M7-SN-23425-6

TABLE V-12--RECREATION FACILITIES ON FEDERAL, STATE, AND INDIAN LAND

CLARK FORK OF THE COLUMBIA RIVER BASIN

Agency or Subarea	Picnic Tables	Camping Spaces	Swimming Beaches	Fishing Sites	Boat Ramps
Federal					
Park Service	0	674	0	9	3
Forest Service	425	1,157	32	82	27
Fish & Wildlife Service	35	0	0	4	0
State of Montana					
Dept. of Fish & Game	396	509	16	59	25
Division of Forestry	0	28	0	3	0
Indian Reservation	5	20	1	1	1
Large Corporation	7	0	4	4	4
Totals	868	2,388	53	162	60
Flathead	437	1,339	29	85	35
Lower Clark Fork	276	684	13	38	20
Upper Clark Fork	155	365	11	39	5
All subareas	868	2,388	53	162	60

Source: Montana Department of Fish and Game July 1976

TABLE V-13--PRIVATE RECREATION FACILITIES 1/
CLARK FORK OF THE COLUMBIA RIVER BASIN

Facilities	Flathead Subarea	Lower Clark Fork Subarea	Upper Clark Fork Subarea 2/	Clark Fork Study Area
Campground spaces	3,064	763	634	4,461
Fishing waters (ponds or lakes)	54	5	10	69
Golf courses	5	8	3	16
Hunting areas				
(no. of enterprises)	10	15	40	65
(acres)	2,688	8,502	13,001	24,191
Picnic tables	11	3	136	150
Racing				
Sites	2	2	3	7
No. spectators	12,000	5,000	1,650	18,650
Rodeo, outdoor theaters, etc. (no.)	7	9	11	27
Acres	66	79	53	198
Snow-ski areas	2	4	4	10
Snowmobile areas (acres)	1,726	1,380	7,626	10,732
Miles of trail	69	7	88	164
Trails, hiking (miles)	52	21	34	107
Trails, horse (miles)	87	73	2,521	2,681
No. horse rentals	318	148	674	1,140
Vacation farms or dude ranches	4	13	18	35
Water sports areas				
Boat ramps (no.)	42	4	4	50
Boat rentals (no.)	217	55	19	291
Boat dry storage	347	1	0	348
Boat slips or morrings (no.)	543	52	96	691
Swimming beach (linear ft.)	12,925	430	150	13,505
Swimming pool (sq. ft.)	9,425	23,325	32,066	64,816

Source: Soil Conservation Service 1976

1/ Only those enterprises which charge a fee and are located on private property were inventoried.
2/ Includes only those portions of Deer Lodge, Lewis and Clark, and Silver Bow Counties in the Clark Fork Basin.

TABLE V-14--URBAN RECREATION FACILITIES PROVIDED BY SCHOOLS AND CITIES
1973

CLARK FORK OF THE COLUMBIA RIVER BASIN

	Flathead Subarea	Lower Clark Fork Subarea	Upper Clark Fork Subarea	Clark Fork Study Area
Indoor ice rinks	0	0	1	1
Outdoor ice rinks	3	4	18	25
Indoor track	1	1	2	4
Outdoor track	6	9	6	21
Football fields	7	8	12	27
Baseball fields	25	31	23	79
Outdoor basketball courts	11	16	19	46
Indoor basketball courts	19	16	27	62
Indoor valleyball courts	15	13	25	53
Outdoor volleyball courts	2	9	6	17
Badminton courts	0	7	0	7
Golf courses	4	1	1	6
Outdoor tennis courts	10	19	16	45
Indoor tennis courts	13	2	0	15
Outdoor swimming area	3	4	3	10
Indoor swimming pool	1	3	4	8
Wading pools	0	8	1	9
Stage	2	2	3	7
Meeting rooms	(- - - - - - - - numerous - - - - - - - - -)			
Tot lots	6	16	22	44
Boating facilities	4	0	0	4
Playgrounds	16	18	26	60
Picnic areas	9	26	7	42
Rifle range	1	0	5	6
Rollerskating rink	0	0	0	0
Bowling alleys	0	0	0	0
Gymnasiums	0	2	22	24
Craft rooms	0	0	2	2
Shelters	6	0	2	8
Toboggan slides	0	0	1	1
Ski runs	1	0	2	3
Handball-Paddleball courts	0	0	4	4

Source: Montana Statewide Survey of Urban Recreation Programs and Facilities, Montana Department of Fish and Game, 1973.

TABLE V-15--HYDROELECTRIC PLANTS

CLARK FORK OF THE COLUMBIA RIVER BASIN

Name	Owner 1/	Date of Acquisition or Completion	Name Plate Capacity 2/	Reservoir Capacity
			(Megawatts)	(Acre-Feet)
Big Creek	FIP	1915	0.36	65
Flint Creek	MPC	1935	1.1	23,300
Milltown	MPC	1929	3.0	300
Bigfork	PPL	1930	4.26	No storage
Thompson Falls	MPC	1929	30.0	15,000
Kerr	MPC	1938	168.0	1,217,000
Noxon	WWP	1960	230.0	380,000
Hungry Horse	BR	1953	285.0	3,468,000

1/ MPC = Montana Power Company
PPL = Pacific Power & Light
BR = U. S. Bureau of Reclamation
FIP - Flathead Irrigation Project
WWP = Washington Water Power Company

2/ Name Plate Capacity is maximum generation capacity with adequate storage.

In addition to hydroelectric facilities, several natural gas and crude oil pipelines pass through and serve the region. There may be potential geothermal sites at eight thermal springs in the basin. They are Hot Springs (Camas) in the Flathead subarea; Paradise, Lolo, Medicine, Gallogly, and Sleeping Child in the Lower Clark Fork subarea; and Gregson and Warm Springs in the Upper Clark Fork subarea. To date, exploration has been conducted only at Hot Springs where experiments were unsuccessful in reaching temperatures great enough for power generation.

There is a small deposit of high quality coal in Flathead County and oil and gas exploration is planned on the periphery of Glacier National Park.

VISUAL RESOURCES

Azure lakes, clear streams, verdant forests, and craggy peaks with scattered glaciers provide scenery for residents and attract visitors from throughout the nation and many foreign countries. Many of these visitors return as residents and land speculators with views of retirement and capitalization of natural beauties. A steady influx of new residents and a prospect of more to follow provide a supply of labor that holds wages at a lower level than most of the rest of the nation and also increases local unemployment rates. Paradoxically, the increase in population, automobiles, horses, and pets changes the natural environment that was instrumental in attracting those new residents. As a result, conflicts arise between those who want to stop development and those who want to capitalize on the scenery or create additional opportunity for employment.

EXISTING PROGRAMS RELATED TO ECONOMIC OBJECTIVES

Many federal, state, and local agency programs and projects provide technical services and financial assistance to meet resource management and development needs in the basin. The public needs to be more aware of services and assistance available through these agencies and the degree to which these programs can be used to meet their needs. USDA agency programs related to planning objectives are listed in table V-16.

(1) Forest is the principal land use in the basin and the principal resource need is improved forest management. Preserving or increasing wood production may be most important in maintaining basic employment in the basin. The Forest Service has a forest management program which is not funded adequately to achieve this component objective. There is also a Forestry Incentives Program and other assistance available from USDA agencies to assist private forest owners in improved forest management. RC&D programs try to develop new manufacturing and employment opportunities.

(2) Structural flood damage reduction programs are available through the Corps of Engineers on major drainages and through the Soil Conservation Service on small watersheds. Under these programs, the Corps has constructed levees near Plains, St. Regis, and Missoula. A major levee project is also being planned for the Flathead River near Kalispell. The Corps has also provided flood-fighting assistance and emergency dike protection during past floods on the Bitterroot, Clark Fork, and Flathead Rivers.

Under the Soil Conservation Service small watershed program, one project has been completed on Cedar Creek near Columbia Falls. Three additional

TABLE V-16--USDA AGENCY PROGRAMS RELATED TO PLANNING OBJECTIVES

CLARK FORK OF THE COLUMBIA RIVER BASIN

COMPONENTS OF OBJECTIVES	PROGRAMS OF AGRICULTURAL AGENCIES						
	SOIL CONSERVATION SERVICE	FOREST SERVICE	ECONOMIC RESEARCH SERVICE	AGRICULTURAL STABILIZATION & CONSERVATION SERVICE	FARMERS HOME ADMINISTRATION	COOPERATIVE EXTENSION SERVICE	RURAL ELECTRIFICATION SERVICE
(1) Sustained Basic Industrial Employment	RC&D PL-92-419	Clark-McNary Act McSweeney-McNary Act Multiple-Use & Sustained Yield Act Coop. Forest Mgmt.	National & Regional Research, Planning, Consultation	---	PL-92-419 FHA Act 1961 RC&D	Smith-Lever Act Ag. Mkt. Act 1946	---
(2) Reduced Flood Damages	PL-566, PL-46 PL-84-1021, RC&D, PL-81-516, PL-92-419	PL-566 PL-81-516 RC&D	do	ACP	PL-566 PL-87-128 FHA ACT 1961	---	---
(3) Increased Production on Wet Cropland	PL-566, PL-46 RC&D	---	do	ACP	FHA Act 1961 PL-566 RC&D	---	---
(4) Improved Late-Season Irrigation Water Supplies	PL-566, PL-46 RC&D	---	do	ACP	do	Smith-Lever Act	---
(5) Improved Municipal Water Supply Systems	RC&D	---	---	---	FHA Act 1961 PL-566,PL-92-419	do	---
(6) Improved Recreational Services on Public Land	---	PL-90-542, PL-566 PL-91-606, Multiple Use & Sustained Yield Act	do	---	---	---	---
(7) Additional Urban Recreational Facilities	RC&D	---	do	---	PL-92-419 RC&D	---	---

Source: Catalog of Federal Domestic Assistance and Agricultural Handbook 453.

TABLE V-16--USDA AGENCY PROGRAMS RELATED TO PLANNING OBJECTIVES (continued)
CLARK FORK OF THE COLUMBIA RIVER BASIN

COMPONENTS OF OBJECTIVES	PROGRAMS OF AGRICULTURAL AGENCIES						
	SOIL CONSERVATION SERVICE	FOREST SERVICE	ECONOMIC RESEARCH SERVICE	AGRICULTURAL STABILIZATION & CONSERVATION SERVICE	FARMERS HOME AOMINISTRATION	COOPERATIVE EXTENSION SERVICE	RURAL ELECTRIFICATION SERVICE
(8) Improved Economic Advice to Private Commercial Recreation	PL-46 RC&D	---	do	---	RC&D	Smith-Lever Act	---
(9) Dispersed Recreational Activity to Improve Quality of Experience	PL-566 RC&D	Multiple-Use & Sustained Yield Act	---	---	---	---	---
(10) Boating Facilities Adapted to Fluctuating Reservoirs	PL-566 RC&D	---	---	---	---	---	---
(11) Improved Efficiency of Agricultural & Forestry Production	PL-566 PL-46 RC&D	Multiple-Use & Sustained Yield Act, Resource Planning Act, Forest Mgmt. Act	do	ACP	PL-566 RC&D FHA Act 1961	Smith-Lever Act	---
(12) Reduced Erosion of "Other" Lands	PL-46 RC&D	do	---	ACP	do	Smith-Lever Act	---
(13) Adequate Electrical Power & Transmission Lines	---	---	---	---	---	---	REA
(14) Keep Better Agricultural & Forested Lands in Present Land Use	RC&D	Multiple-Use & Sustained Yield Act, Resource Planning Act, Forest Mgmt. Act	do	---	---	Smith-Lever Act	---
(15) Reduced Erosion & Sediment Production from Ag, Forest, & Other Land	PL-566, PL-46 PL-84-1021 RC&D, PL-92-419	Multiple-Use & Sustained Yield Act	do	ACP	PL-566, RC&D PL-87-128 FHA Act 1961	do	---

Source: Catalog of Federal Domestic Assistance

TABLE V-16--USDA AGENCY PROGRAMS RELATED TO PLANNING OBJECTIVES (continued)
CLARK FORK OF THE COLUMBIA RIVER BASIN

COMPONENTS OF OBJECTIVES	PROGRAMS OF AGRICULTURAL AGENCIES						
	SOIL CONSERVATION SERVICE	FOREST SERVICE	ECONOMIC RESEARCH SERVICE	AGRICULTURAL STABILIZATION & CONSERVATION SERVICE	FARMERS HOME ADMINISTRATION	COOPERATIVE EXTENSION SERVICE	RURAL ELECTRIFICATION SERVICE
(16) Reduced Streambank Erosion	PL-81-516, RC&D PL-46, PL-566	do	---	ACP	do	do	---
(17) Reduced Sewage and Industrial Pollution of Water	PL-92-419, RC&D PL-46	---	---	---	do	Smith-Lever Act Ag. Mkt. Act 1946	---
(18) Reduced Non-point Water Pollution From Agricultural and Forested Lands	PL-46, PL-566 RC&D, PL-92-419	Multiple-Use & Sustained Yield Act	---	ACP	do	do	---
(19) Reduced Water Fluctuations of Reservoirs	---	---	---	---	---	---	---
(20) Protected Riparian Vegetation	PL-46	Multiple-Use & Sustained Yield Act, PL-91-190	---	ACP	---	---	---
(21) Dispersed Recreational Activity to Preserve Environment	---	Multiple-Use & Sustained Yield Act, Condemnation	---	---	---	---	---
(22) Protected Open and Green Space	---	Multiple-Use & Sustained Yield Act	do	---	---	---	---
(23) Protected Free-flowing Streams	---	Multiple-Use & Sustained Yield Act, Wild & Scenic Rivers Act	do	---	---	---	---
(24) Protected Minimum Stream Flows	---	---	do	---	---	---	---

Source: Catalog of Federal Domestic Assistance

TABLE V-16--USDA AGENCY PROGRAMS RELATED TO PLANNING OBJECTIVES (continued)
CLARK FORK OF THE COLUMBIA RIVER BASIN

COMPONENTS OF OBJECTIVES	PROGRAMS OF AGRICULTURAL AGENCIES						
	SOIL CONSERVATION SERVICE	FOREST SERVICE	ECONOMIC RESEARCH SERVICE	AGRICULTURAL STABILIZATION & CONSERVATION SERVICE	FARMERS HOME AOMINISTRATION	COOPERATIVE EXTENSION SERVICE	RURAL ELECTRIFICATION SERVICE
(25) Controlled Temperature & Fluctuations in Flow From Hungry Horse Reservoir	---	---	---	---	---	---	---
(26) Protected Wildlife Habitat	PL-46	Multiple-Use & Sustained Yield Act	do	do	---	---	---
(27) Improved Fish Passage Around Structural Barriers	PL-46	do	---	---	---	---	---
(28) Keep Critical Wildlife Habitat in Present Use	RC&D PL-46	do	do	ACP	---	---	---

Source: Catalog of Federal Domestic Assistance

applications for projects which could reduce floods on other watersheds have been made, but are now in an inactive status.

Both the Corps and the SCS conduct flood plain delineation studies in conjunction with the state flood plain management program and with the HUD flood insurance program. The USGS and private engineering consultants are also often contracted by HUD to perform such studies. Flood plain studies for the state program have been completed by the Corps for the Clark Fork River from Missoula to Alberton; the Flathead River from Columbia Falls to Kalispell; Cottonwood Creek in Deer Lodge; and a five-mile portion of Lolo Creek near Missoula. Other flood plain studies have been completed for the Bitterroot River from Missoula to Darby and the Clark Fork River from Missoula to near Bearmouth by the University of Montana Department of Geology; and for Rock Creek in Missoula and Granite Counties by the USGS and the Montana Department of Natural Resources and Conservation.

Flood plain studies are presently under way on a five-mile portion of Rattlesnake Creek near Missoula (Corps) and for Warm Springs Creek near Anaconda (SCS). Both of these studies should be completed by July 1977.

Private consultants have recently been contracted by HUD to do detailed flood plain studies for drainages within Missoula, Silver Bow, Flathead, and Lincoln Counties. All these studies are scheduled for completion by 1978.

Comprehensive flood plain regulations under the Montana Floodway Management and Regulation Act are presently in effect for the Clark Fork River from Missoula to Alberton, the Bitterroot River from Missoula to above Darby, Rock Creek from its mouth upstream to the junction of East and West Forks, and Cottonwood Creek within the Deer Lodge city limits. Limited flood plain land use regulations are also presently in effect in Philipsburg, Butte, Anaconda, Columbia Falls, Whitefish, and the unincorporated areas within Flathead and Lewis and Clark Counties. Flood insurance is presently available in Butte, Philipsburg, Anaconda, Missoula, Missoula County, Columbia Falls, Whitefish, Flathead County, and Lewis and Clark County.

(3) Drainage of high water table areas on types I and II wetlands is possible under Conservation District programs with technical assistance provided by SCS. About 12,800 acres have been drained to date.

(4) Irrigation water improvement projects have been built by the Bureau of Reclamation, Flathead Irrigation Project (BIA), the Water Resources Division of the Montana Department of Natural Resources and Conservation (formerly the Montana Water Resources Board), and private irrigation companies--some with PL-566 and RC&D assistance from the Soil Conservation Service. Bureau accomplishments, partly under its old name of Reclamation Service, included the development of the Flathead Irrigation Project in Lake, Missoula, and Sanders Counties in 1907-1911, which was later turned over to the BIA in 1924. The BIA agency has installed a number of improvements to this system. In 1930 the Bureau rehabilitated and enlarged the

facilities of the Bitterroot Irrigation District and further rehabilitation was undertaken in 1936, 1948, and 1956. In 1935, the Bureau constructed the Frenchtown Irrigation Project near Missoula and in 1939 built the Big Flat Unit of the Missoula Valley Project.

The MDNR&C administers five irrigation developments in the basin. In Granite County, the MDNR&C built the project now operated by the Flint Creek Water Users Association, which includes a storage reservoir on the East Fork of Rock Creek and canal systems in the lower Flint Creek drainage. In Powell County, the Department built the project now operated by the Nevada Creek Water Users Association near Helmville in the Blackfoot River drainage. This latter project consists of the Nevada Creek Reservoir and a system of delivery canals. In Ravalli County, the MDNR&C owns a water storage project on the West Fork of the Bitterroot River about 40 miles south of Darby. This project, called Painted Rocks Reservoir, has 31,704 acre-feet of capacity and was built to supply water to irrigators diverting water out of the Bitterroot River as far downstream as Missoula. The only repeated annual sale of the stored water has been to the Department of Fish and Game for the purpose of regulating stream flows for fisheries. The Department's Fred Burr Creek project has a 515 acre-feet reservoir and provides supplemental water to 835 acres operated by the local water users association. The Ravalli Water Users Association (Daly Ditch Project) was conveyed to the MDNR&C on October 1, 1942. The project consists of several irrigation canals and three small storage reservoirs. Most of the water of this project comes from the Bitterroot River. The project has a total of 12,000 acres irrigated on over 300 farms and tracts.

The Renewable Resource Development Loan Program initiated in 1976 by the MDNR&C makes two and one-half percent of the Montana Coal Tax available for loans to farmers and ranchers in Montana for irrigation development, forest management, and fish and wildlife improvement.

It is estimated that an increasing amount of money will be available for developing wells and irrigation systems, repairing reservoirs and ditches, improving forest practices, establishing permanent pastures and farm forests, developing fish production structures, constructing erosion-control structures, and leveling land.

In addition, the Technical Assistance Program of MDNR&C will assist local groups by completing preliminary (prefeasibility) investigations of proposed multipurpose water and related lands development projects. This program is intended to initiate water development projects designed for domestic, municipal, industrial, irrigation, fish and wildlife, recreation, flood control, water quality maintenance and improvement, drainage, and sediment and erosion control.

The Soil Conservation Service designed the Lower Willow Creek PL-566 project in Granite County in 1962 and has received seven other applications for PL-566 assistance on irrigation projects. Under PL-46 programs, and private projects without assistance, about 27 miles of irrigation canals have been lined. About 139,400 acre-feet of irrigation water storage has been provided. About 168,000 acres of the existing 193,000 acres of sprinklers have been installed with SCS assistance.

Private irrigation companies were the original developers of most of irrigated land in the basin. Most of the development in the past decade has been by individual farmers or small private groups; this pattern is expected to continue with the availability of state and federal assistance.

(5) Nearly all communities have a municipal water supply system; some are not fully adequate. Community water supply development assistance is available for smaller communities through programs of the Farmers Home Administration and for larger cities under programs of HUD. Little use has been made of these programs in the basin.

(6) Recreation facilities on public land were developed under programs of the National Park Service, Forest Service, and Montana Department of Fish and Game. These programs will continue to supply diverse recreation opportunity.

(7) Recreation facilities for urban communities are developed in cooperation with Bureau of Outdoor Recreation programs directed through Montana Department of Fish and Game. This program is expected to continue as state and local funds become available.

(8) Advice to private recreation developers is available through SCS, Cooperative Extension Service, and Small Business Administration.

(9) Forest Service programs could provide 20 additional access points to public land by 1990. Fish and Game programs could provide 21 more fishing access points to streams and lakes by 1990.

(10) BOR programs directed through the Montana Department of Fish and Game could be used to develop boat ramps and floating docks on five reservoirs by 1990.

(11) Over the years, PL-46 land treatment programs with ASCS and SCS assistance have improved production on about 370,000 irrigated acres and 1,000,000 acres of range. Some of these acreages are recurring management practices due to change in ownerships. Stand improvement and reforestation will improve timber production on 369,000 acres of National Forest land and 55,000 acres of private commercial forest land by 1990.

(12) Erosion damage has been reduced through land treatment under PL-46 programs on 63,000 acres of "other" lands and will be reduced on 28,000 more acres by 1990.

(13) The largest private water development projects in the basin are hydroelectric projects on the Flathead and Clark Fork Rivers. These include Kerr Dam, 1,219,000 acre-feet; Noxon, 380,000 acre-feet; Thompson Falls, 69,400 acre-feet; and Cabinet Gorge, with its dam in Idaho and its storage pool mostly in Montana. Other power dams are at Milltown, Bigfork, Georgetown, and Big Creek. Hungry Horse Reservoir dominates federal agency power generation efforts and accomplishments in the basin. The 3,668,000 acre-feet of storage provide flood prevention, irrigation, and power generation. Counting dual purpose capacity, there are 2,982,000 acre-feet useable for flood prevention storage. However, the most significant benefits derive from the power generation and regulating effect on downstream reservoirs. Most of the power generated by Hungry Horse is used by the Anaconda Company plant near Columbia falls. The aluminum plant provides a significant part of the basic employment of Flathead County.

Bonneville Power Administration has the responsibility for coordination of public power transmission in the Pacific Northwest while the Corps of Engineers and Federal Power Commission will be the major agencies having input in future project development in the basin.

Utility companies and even the Confederated Salish-Kootenai Tribes may be involved in private power development in the future.

(14) The Montana Subdivision and Platting Act was enacted in 1973. The intent was to slow the rate of subdivision and improve the quality of subdivision development by making all subdivisions less than 20 acres in size subject to local government and public review. However, exemptions were allowed for occasional sale and for transfer to family members. Evidence now available indicates that the law has not slowed the number of subdivisions, but may have increased the average size of a subdivided lot. Most subdivision is being accomplished under the provisions for exemptions. The quality of subdivisions subjected to political review is generally higher than in those which are not reviewed.

EXISTING PROGRAMS RELATED TO ENVIRONMENTAL OBJECTIVES

(15)(16) Erosion and sedimentation problems have been addressed by many agencies. Under authority of PL-46, the Soil Conservation Service provides technical service through the direction of the local Conservation Districts.

Conservation practices which reduce erosion have been applied to about 154,000 acres of dry cropland; 1,000,000 acres of rangeland; 60,000 acres of other lands; and on one mile of streambank on the Blackfoot and Little Bitterroot Rivers. With ongoing programs, the SCS could provide assistance for additional erosion control on 62,500 more acres of dry cropland; 640,000 acres of rangeland; 28,000 more acres of other lands; and on one more mile

of streambank on the Blackfoot and Little Bitterroot Rivers by 1990. ASCS will continue to provide financial assistance for such practices.

The U. S. Forest Service has provided erosion control along roads and other problem areas on lands it controls. With continued ongoing programs it could provide erosion protection on 424,000 acres of forest land and a few miles of streambank, roads, and trails by 1990.

Other agencies such as the Bureau of Land Management, the Bureau of Indian Affairs, the National Park Service, the Fish and Wildlife Service, and the Montana Department of State Lands have provided erosion and sedimentation management on lands over which they have administrative control.

(17) Federal cost sharing to communities under PL-92-500 is allocated under a statewide priority system administered by the Montana Department of Health and Environmental Sciences and the Environmental Protection Agency. Approximately $1,800,000 of cost sharing funds have been used to begin upgrading ten sewage facilities in local communities. Based upon current funding levels, approximately $13,000,000 of cost sharing funds could be shared with 25 communities for improving sewage treatment facilities by 1990. Industrial waste treatment is regulated by the Montana Department of Health and Environmental Sciences, with Environmental Protection Agency assistance.

(18) Irrigation water management helps to control water pollution by a decrease in the amount of irrigation return flows and runoff. Approximately 133,500 acres out of 452,630 irrigated now have adequate irrigation water management. About 193,000 acres have sprinkler systems. Based upon present rates of application, about 324,000 acres of irrigation water management could occur by 1990 and on all irrigated areas by 2020.

(19) Control of water fluctuations on reservoirs is under the management of the agency or individual responsible for the particular reservoir. The Army Corps of Engineers, the Bureau of Reclamation, the Bonneville Power Administration, the Montana Department of Natural Resources and Conservation, and private irrigation companies currently control reservoirs for the express purpose of irrigation and power generation. Management of these reservoirs for scenic beauty is not anticipated.

(20) Protection of vegetation along rivers and streams has not been under the control of any agency or land management group. Partial accomplishment of this goal may be accomplished by: scenic and wild rivers designation; streambank protection laws such as SB-310 under the direction of Conservation Districts; the Corps of Engineers "section 404" and "section 10" permits; and stream hydraulic permits which are issued by the Montana Department of Fish and Game. Approximately 25,000 acres of vegetation is protected by wild and scenic river designation.

(21) Additional access to public lands is needed to alleviate crowding of existing access sites. The U. S. Forest Service has provided 650 developed and undeveloped access sites and could provide 20 additional developed access sites by 1990. Many of the 650 sites still require establishment of legal rights-of-way in order to ensure continued public use.

(22) Control and management of land for protection of open and green space have been partially accomplished in recent times by various laws and land use practices. Zoning regulations are beginning to have some impact on the urban sprawl problem, and management agencies are becoming increasingly aware of open and green space and scenic beauty as a component of integrated land management.

(23) Preservation of all presently free-flowing streams would require the prevention of any new reservoirs or diversion dams.

(24) Minimum streamflows for fish and wildlife are presently not being maintained. Fish and wildlife became beneficial users of water under the 1973 Montana Water Use Act, and reservations of water can now be filed for these purposes. On many small streams where dewatering is a problem, all existing water has been allotted for irrigation purposes and a reservation of water would be impractical. It is anticipated that a small watershed project could provide minimum streamflows in 32 miles of stream by 1990.

(25) Modification of Hungry Horse Dam and its operation or construction of a reregulating dam to provide reduction of extreme flow and temperature fluctuations would be under the authority of the Department of the Interior, Bureau of Reclamation. There are no completed plans for these modifications at present.

(26) Management of big game, upland, and wetland wildlife habitat has been partially accomplished by various agencies. The Montana Department of Fish and Game has purchased or leased approximately 69,000 acres of big game winter range. At current funding rates, an additional 50,000 acres could be under their management by 1990.

Upland habitat management occurring on private land has been partially accomplished by ASCS cost-share funding with SCS technical assistance. About 600 acres of shelterbelts and wildlife areas have been installed and managed. At current rates, another 300 acres of shelterbelts and wildlife areas could be installed by 1990. Approximately 3,200 acres of upland game management areas have been purchased or leased by the Department of Fish and Game. Based upon the present federal-state cost-share structure, an additional 2,500 acres of upland wildlife habitat could be purchased or leased by 1990.

Preservation of wetland areas is being partially accomplished by purchase and/or lease of those areas showing the most promise as waterfowl production areas. Approximately 3,140 acres of wetland and adjacent uplands have been purchased by the Montana Department of Fish and Game. Approximately

8,680 acres of wetland and adjacent uplands have been purchased by the U. S. Fish and Wildlife Service. Based upon past purchases, about 1,680 acres of wetland could be purchased or leased by the Montana Department of Fish and Game by 1990, and about 6,510 acres of wetland could be purchased by the U. S. Fish and Wildlife Service by 1990.

(27) Recent structures, such as diversion dams, culverts, and bridges, which have been installed in trout streams have generally been designed with fish passage. Provision of fish passage around existing stream blockages is the responsibility of the company or agency which owns or controls the structure. Fish passage around existing stream blockages can be provided under ongoing programs of the Forest Service on national forest lands and under RC&D programs in RC&D areas.

(28) See economic objective number (14).

VI--FUTURE CONDITIONS WITHOUT COORDINATED PLANNING

Future conditions, as presented here, are those that are projected from current trends in population, anticipated changes in technology, and continuation of ongoing programs and projects as restricted by limitations of natural resources and climate. Even without coordinated planning, existing projects and programs, as identified in chapter V, will satisfy part of the NED and EQ component desires identified in chapter IV. These projected "conditions without coordinated planning" were compared with desired conditions enumerated in chapter IV to measure the remaining desires or unmet needs described in chapter VII.

ASSUMPTIONS

-- Population is projected to increase from 204,000 in 1970 to 232,000 in 1990 and to 284,000 in 2020 as based on OBERS series C population projections for this water resource area.

-- Although some crop production will change, types and acreages of crops will still be predominantly forage and small grains. Crop yields will increase most where conventional irrigation changes to sprinkler irrigation, but will increase less on mountain meadow irrigation or dryland.

-- Commercial sawtimber available for boards and dimension lumber will continue to decline. The use of smaller trees for pulp, chipboard, and particleboard products will increase.

-- Some agricultural and forest land will continue to be subdivided and removed from food and fiber production.

-- Based on metal commodity markets, corporate stock market news, and reports of other world mineral discoveries and development, it appears likely that economically useable materials in the Butte area will be depleted long before 2020. As these resources are used up, employment and population in that area will continue to decline.

-- Other than ore depletion at Butte, none of the physical or climatic characteristics of the basin are expected to change materially by 2020.

-- Because of the distances from population and heavy manufacturing centers, climate limitations, and freight rate structures, the principal exports from this basin will continue to be refined metals, lumber, other wood products, beef, seed potatoes, and grains.

-- Only minor changes will occur in private ownership rights in land and use rights in water.

-- New laws will increase the limiting factors on the rights of landowners and water users.

-- Employment will continue to decline in basic industries and increase in service industries and government.

-- Air and water pollution control will improve in proportion to the degree of enforcement of existing laws. Such enforcement may be severely limited by lack of funds for personnel, court action, or prohibitive costs for installation of pollution abatement facilities.

-- The population increase will be accompanied by an increased use of land, water, and air.

-- Private irrigation development will continue to take more water from streams and rivers at some detriment to fisheries.

-- Subdivision developments will continue to encroach on forest fringes, streambanks, and lakeshores, thereby reducing fish and wildlife habitat, winter game range, and natural beauty.

Table VI-1 shows estimates of the NED results of continuing existing agency programs.

GENERAL DESCRIPTION OF FUTURE CONDITIONS WITHOUT COORDINATED PLANNING

LAND USE CHANGES BY 1990

Some forest and rangeland will be subdivided and some is being converted to irrigated crops. Some dry cropland will become irrigated cropland and subdivisions. Some irrigated cropland will also be subdivided. "Other" lands will be increased by subdivisions, roads, and utility line construction. Most noticeable will be more houses near streams, lakes, and forest fringes. These residential encroachments will reduce fish and wildlife habitat and reduce the populations of game animals. Some rangeland and marginal forest land may be reserved for winter game range. More wetland will be reserved as waterfowl refuges. Table VI-2 shows the projected use of State and private lands in 1990.

TABLE VI-1--SOME ECONOMIC DEVELOPMENT CONDITIONS EXPECTED BY 1990 IF ONGOING PROGRAMS ARE NOT CHANGED

CLARK FORK OF THE COLUMBIA RIVER BASIN

Component Addressed	Project or Program	Agencies and Individuals Involved	Results
NED			
(1) Maintain basic industry employment	Industry	Individuals, corporations Chambers of Commerce, cities, states, etc.	Loss of 1,950 more basic jobs for deficit of 7,350 needed to support 1990 population.
(2) Reduced flood damages	National Flood Insurance Montana laws, and Corps of Engineers project	Dept. of Housing & Urban Development, State of Montana, counties, cities, towns, individuals, and Corps of Engineers	Residential flood hazards will not increase; some areas will be protected, and flood insurance will be available.
(3) Improved drainage of cropland now classed as types I and II wetland	Private action with USDA technical and financial assistance; RC&D project measures, or small watershed project	Soil Conservation Service, Agricultural Stabilization & Conservation Service, and landowners	7,000 more acres drained by 1990.
(4) Full season water supply for presently irrigated land; new irrigation on 14,000 acres will use 35,000 acre-feet. New supplemental water of 2,000 acre-feet to benefit 2,400 acres now irrigated. 126,000 acres converted to sprinklers.	Small watershed projects, RC&D project measures, and individual action	Landowners with financial and technical assistance from USDA agencies	About 15,200 acre-feet of water stored to provide a full supply on 10,500 acres now short of late-season water.

TABLE VI-1--SOME ECONOMIC DEVELOPMENT CONDITIONS EXPECTED BY 1990 IF ONGOING PROGRAMS ARE NOT CHANGED

Component Addressed	Project or Program	Agencies and Individuals Involved	Results
(5) Adequate water supplies and systems for all communities	Community action projects	Department of Housing and Urban Development, Environmental Protection Agency, State of Montana, and communities with financial assistance from FmHA	4 communities will upgrade their water supplies
(6) Improved public outdoor recreation facilities	Outdoor recreation	Forest Service, Bureau of Land Management, and Montana Department of Fish and Game	Outdoor recreation facilities on public lands will be provided for 16 more camper stalls at critical overuse sites
(7) Adequate supply of urban recreation facilities	Community recreation	Bureau of Outdoor Recreation, Department of Housing and Urban Development, State of Montana, counties, and local communities	Adequate facilities can be made available as local funds are obtained.
(8) Education and technical assistance for private recreation	Conservation operations	Private landowners with technical assistance from SCS and other state and federal agencies	Private recreation facilities will be upgraded as technical assistance is sought and provided. The locations, sizes, and types of facilities will depend on local market conditions.

TABLE VI-1--SOME ECONOMIC DEVELOPMENT CONDITIONS EXPECTED BY 1990 IF ONGOING PROGRAMS ARE NOT CHANGED

Component Addressed	Project or Program	Agencies and Individuals Involved	Results
(9) Additional recreation access to public land and water and fishing access easements on private land	Property acquisition programs	Forest Service and Montana Department of Fish and Game	22 more stream fishing access sites and 20 more public land general recreation access sites by 1990.
(10) More boat ramps and docks adapted to reservoir fluctuations	Water-borne recreation development	Forest Service, BOR, and Montana Department of Fish and Game	Boating access facilities on 5 more reservoirs
(11) Improved efficiency of agricultural and forestry production through improved land treatment (including improved agricultural water management)	Natural resource management operations	USDA, USDI, and State agencies and private landowners	Improved agricultural water management on 84,000 more acres of irrigated cropland and conversion of 126,000 other acres to sprinkler irrigation; improved grazing management on 640,000 acres of range; forest production increased on 424,000 acres. In spite of improved land treatment, the annual allowable cut of sawtimber and veneer logs will decrease by 13.5 million cubic-feet by 1990.
(12) Protect "other" land from erosion damage	Natural resource management operations	Private landowners with USDA technical and financial assistance	28,000 more acres protected by 1990.

TABLE VI-1--SOME ECONOMIC DEVELOPMENT CONDITIONS EXPECTED BY 1990 IF ONGOING PROGRAMS ARE NOT CHANGED

Component Addressed	Project or Program	Agencies and Individuals Involved	Results
(13) Routes for new electrical transmission lines	Private industry	Private industry, Forest Service, State of Montana, BLM, Flathead Irrigation Project, Bonneville Power Administration	Adequate electricity will be provided. Local service transmission lines will be completed as needed. Additional long distance lines will also be built as needed. Run of the river generating sites at Buffalo Rapids #2 and #4 may be under design or construction by 1990.
(14) Continued subdivision of private lands	Private industry	State and local governments with technical assistance from SCS and FS	Estimated conversion to subdivisions of 47,000 acres of a mixture of agricultural and forested lands.

TABLE VI-2--PROJECTED LAND USES OF STATE AND PRIVATE LANDS
IN THE TEN-COUNTY STUDY AREA IN 1990

CLARK FORK OF THE COLUMBIA RIVER BASIN

Subarea and County	Forest	Range	Irrigated Crop and Pasture	Nonirrig. Crop and Pasture	Urban and Builtup Subdivision	Other Ag. Land	Total State and Private
	- - - - - - - - - - - - - - - - - - acres -
UPPER CLARK FORK							
Deer Lodge	119,280	146,860	25,100	2,100	19,950	1,900	315,190
Granite	158,550	181,850	41,680	9,280	6,200	2,900	400,460
Powell	278,300	361,700	74,430	30,000	14,110	6,450	764,990
Silver Bow	50,050	143,000	9,030	3,730	13,320	1,470	220,600
Total	606,180	833,410	150,240	45,110	53,580	12,720	1,701,240
LOWER CLARK FORK							
Mineral	116,310	520	1,960	3,560	9,240	1,340	132,930
Missoula	796,120	73,170	27,530	[illegible],890	30,980	12,440	963,130
Ravalli	159,190	94,060	110,590	15,510	16,080	10,880	406,310
Sanders	498,660	250,800	26,030	49,670	14,230	9,690	849,080
Total	1,570,280	418,550	166,110	91,630	70,530	34,350	2,351,450
FLATHEAD							
Flathead	651,710	49,070	32,460	95,650	29,530	9,110	867,530
Lake	374,080	178,690	101,720	81,510	29,550	12,060	777,610
Total	1,025,790	227,760	134,180	177,160	59,080	21,170	1,645,140
TEN-COUNTY TOTAL	3,202,250	1,479,720	450,530	313,900	183,190	68,240	5,697,830

Source: River Basin staff estimates based on present use that would be changed by subdivision and new irrigation development.

AGRICULTURAL PRODUCTION BY 1990

Cash crops production of grain and seed potatoes will be about the same as at present. Sugar beet production will have disappeared, while hay and irrigated pasture will have increased due to increased irrigation and shifts to sprinkler irrigation. The 1990 crop production is expected to be:

Crop	Units	1990	Current Normal	Increase
Wheat	bushels	2,409,000	1,966,000	433,000
Oats	bushels	616,000	488,000	128,000
Barley	bushels	2,596,000	2,249,000	347,000
Potatoes	cwt	1,020,000	1,012,000	8,000
Sugar beets	tons	-0-	12,600	-12,600
Corn silage	tons	20,000	18,000	2,000
Hay	tons	739,000	673,000	66,000
Pasture & range	AUMs	1,816,000	1,177,000	639,000

This production is based on the assumptions that average yields by 1990 will be equal to current yields from the upper 10 percent level of management. That management includes improved land treatment, more fertilizer use, better varieties, and better water management.

FORESTRY PRODUCTION BY 1990

The total annual volume of wood harvested from commercial forests, with ongoing levels of management, is expected to decline from the 1970 harvest of 121.8 million cubic-feet to 109.0 million cubic-feet by 1990. This harvest is dominated by saw and veneer log production which is expected to decline from 719 million board-feet in 1970 to 637.5 million board-feet in 1990. Employment associated with saw and veneer log production will decline from 5,300 in 1970 to 4,600 in 1990. This decline will be due to both the drop in production and to improvements in labor productivity.

Investments in new techniques that make better use of wood from small, dead, or crooked trees and from presently noncommercial species will only partly offset the effects of the reduction of saw and veneer log production. The production of this wood is expected to increase only from 2.7 million cubic-feet in 1970 to 3.4 million cubic-feet in 1990. Employment associated with this production and with forest management is expected to increase from 1,300 in 1970 to 1,700 in 1990 and will require new skills in the labor force. The net change in forest sector employment will be a drop from 6,600 in 1970 to 6,300 in 1990.

WATER USE BY 1990

Measurable changes in consumptive use of water will be dominated by increases in private irrigation. About 2,000 more acre-feet of stored water will be used in late summer on acres now irrigated and 35,000 more acre-feet will be used on 14,000 acres newly irrigated land. However, a savings of about 126,000 acre-feet from conversion of 126,000 acres of flood irrigation to sprinkler irrigation will result in a net basin

reduction of 89,000 acre-feet used in irrigation. Although there would be an increase of 14,000 acres of new irrigation and an increase of 2,400 acres shifting to a full supply, there would be a loss of 16,100 acres of irrigated land to subdivisions. Assuming slightly more subdivision of water-short land than full-supply land, it is projected that by 1990 there will be 253,000 acres of full supply irrigated crop and pasture and 197,500 acres still having shortages for a total of 450,500 acres of irrigated crop and pasture land. The 16,100 acres moving into subdivision will retain their water rights and use about the same amount of water now used. Although municipal and industrial use of water will increase in proportion to increases in population and manufacturing, the increased consumptive use will be insignificant when compared with total water available in the basin.

OTHER CHANGES BY 1990

Recreational use is expected to increase in proportion to increases in national and regional population with some dampening effect from gasoline shortages and increasing prices. Recreation activity occasions are projected to increase from 14,868,000 in 1970 to 21,870,000 in 1990.

SPECIFIC DESCRIPTION OF FUTURE CONDITIONS WITHOUT COORDINATED PLANNING

The following items refer to changes in specific components identified in chapter III.

NATIONAL ECONOMIC DEVELOPMENT

Examples of projected accomplishments by 1990 as related to specific NED objective components include:

(1) Basic industry employment will decrease by about 300 man-years in forest products even with more intensive manufacture of wood products. Mineral employment and agricultural employment will continue to decline. Employment in light industry is expected to increase. Employment in recreation and tourism is expected to increase though probably at a slower rate than in the past because of the energy shortages. Total net decrease in basic employment is estimated at 1,950 full-time jobs for a deficit of 7,350 basic employment jobs needed for the projected 1990 basin population of 232,000.

(2) Flooding will continue to have only a minor effect on agricultural production and generally is not a hazard to life. The Corps of Engineers Flathead Project will reduce damages to about 7,000 acres of agricultural land and 787 residential units near Kalispell by 1990. About 64,000 acres

of agricultural lands will still be subject to occasional flooding. As presently evaluated, the economic benefits from preventing these losses are insufficient to justify structural measures, thus flood damage reduction is eliminated as an NED plan element and will be treated as an incidental benefit where multipurpose structures reduce flood flows. Ongoing programs described in chapter V will provide flood insurance to ease the impacts of residential flooding. Flood damage repairs using funds provided under the flood control act of 1950 (Section 216 of Public Law 81-516) pertain more to safeguarding of lives and prevention of erosion and are environmentally oriented and not evaluated for economic feasibility as required for NED components.

(3) Additional cropland drainage under existing programs will increase production on only 7,000 acres by 1990 as based on current rates of agricultural drainage.

(4) By 1990, late-season irrigation water supplies will be improved by 2,000 acre-feet for about 2,400 acres with USDA-assisted projects. However, 8,100 acres of presently irrigated land (now short 13,200 acre-feet) will be lost to subdivision. This will reduce water-short acres by a total of 10,500 acres and water shortage by 15,300 acre-feet.

(5) Municipal water systems will be improved for three small towns under FmHA programs and one city under HUD programs.

(6) Public outdoor services will not be adequately adjusted in number, type, and location under existing programs of the National Park Service, Forest Service, and other agencies. For the national forest land, the level of recreational maintenance will continue at $605,000 per year and new construction will continue at $1,000 per year and provide 16 additional camping stalls.

(7) Urban recreational facilities will be provided as local matching funds become available. Present programs of BOR and Montana Department of Fish and Game are adequate to meet the needs by 1990.

(8) Private recreational facilities will adjust in type and numbers by 1990 through the process of economic attrition.

(9) Fishing access points will increase by 22 stream sites by 1990 under Montana Department of Fish and Game programs. Access points to public lands will increase by 20 sites under acquisition programs of the Forest Service.

(10) Boating access facilities will be developed on 5 reservoirs under BOR programs administered by Montana Department of Fish and Game.

(11) Land treatment on agricultural land, other than that shown in items (3) and (4), will be improved and production will increase as 126,000

more acres of currently irrigated land is converted to sprinkler irrigation and 84,000 more acres are changed to approved water management systems. Irrigation system as referred to in the report means a planned irrigation system where all necessary water control structures have been installed for the efficient distribution of irrigation water. Irrigation water management means determining and controlling the rate, amount, and timing of irrigation water application to soils to supply plant water needs in a planned and efficient manner. Production will increase on 640,000 acres of range as better grazing management is adopted. Land treatment on dry cropland is discussed under EQ items (18) and (19). Forestry production will be increased on 424,000 acres of commercial forest under ongoing forestry programs. In spite of this treatment, the allowable cut of timber will decline by 13.5 million cubic feet by 1990.

Increases in production of agricultural commodities resulting from land treatment are estimated at:

Wheat	bushels	354,000
Oats	bushels	102,000
Barley	bushels	278,000
Hay	tons	53,000
Pasture & range	AUMs	639,000

(12) Treatment of "other" land under ongoing programs will protect 28,000 more acres by 1990.

(13) By 1990, additional large-capacity transmission lines will have been constructed to carry large quantities of electricity into and through the basin. These will have been built under programs of Bonneville Power Administration and private public utility companies. Also, by 1990, the hydroelectric dams of Buffalo Rapids #2 and #4 may be under construction. Thus, plans have been made for adequate electricity supplies through 1990.

(14) There will be some continued subdivision of agricultural and commercial forest land, but existing laws requiring that subdividers provide detailed planning and show need for each subdivision will have slowed this activity. Subdivisions will take 47,000 more acres out of agricultural and forest production by 1990.

ENVIRONMENTAL QUALITY

Examples of projected accomplishments by 1990 as related to EQ specific objective components include:

(15)(16) SCS will provide assistance for erosion control on 62,500 more acres of dry cropland; 640,000 more acres of rangeland; 28,000 more acres of other lands; and one more mile of streambank protection on the Blackfoot

and Little Bitterroot Rivers. U. S. Forest Service will provide erosion and sediment control on 1,000 acres of forest land and 40 miles of roads and trails.

(17) Communities under FmHA loan programs or Environmental Protection Agency programs will develop 16 secondary sewage treatment facilities. Industrial wastes will be controlled by all companies by 1990.

(18) SCS will provide assistance for 84,000 more acres of irrigation water management and 126,000 acres converted to sprinkler to improve water quality of return flows from 210,000 acres.

(19) Reservoir management for scenic beauty purposes is not anticipated.

(20) Protection of 25,000 acres of riparian vegetation will be provided by designation of wild and scenic rivers. The Montana lakeshore protection law and the streambed preservation act as well as ongoing forest management programs will provide some additional protection.

(21) The U. S. Forest Service will provide 20 additional access points to national forest land.

(22) Zoning and land management for preservation of open and green space will continue at a slow rate.

(23) Protection of free-flowing streams will probably not exceed the 219 miles of rivers which are designated as scenic or wild rivers.

(24) Small watershed projects will provide minimum streamflow in 32 miles of stream.

(25) Hungry Horse dam is not expected to be changed significantly--either in design or operation.

(26) The Montana Department of Fish and Game will purchase and develop an additional 50,000 acres for big game winter range. Private landowners and the Montana Department of Fish and Game will cooperate in developing an additional 2,800 acres of upland game habitat. The U. S. Fish and Wildlife Service and the Montana Department of Fish and Game will purchase and preserve about 8,200 more acres of wetland habitat by 1990.

(27) A few structures that restrict fish travel are expected to be removed, but most are expected to remain.

(28) Subdivisions will continue to encroach on wildlife habitat.

OTHER CONDITIONS

In the national forests of the Clark Fork River Basin in Montana, 72 areas totaling 2.4 million acres have been identified by the Forest Service for evaluation to determine which areas should be added to the National Wilderness Preservation System. The identification of roadless areas came after the Forest Service conducted numerous public workshops during the summer of 1977 as part of a nationwide Roadless Area Review and Evaluation (RARE II). Approximately 3,500 persons participated in 19 RARE II workshops conducted in Montana and northern Idaho.

The RARE II evaluation phase will examine wilderness, social, and economic values of the roadless areas to determine which areas will be recommended to help complete a well-rounded National Wilderness Preservation System. Criteria to be used in selecting the wilderness candidates include:

1. Representation of the nation's major ecosystems and landforms.

2. The presence of certain wilderness-associated wildlife habitat.

3. Availability and distribution of areas so they are readily accessible to the nation's population.

A final report and environmental impact statement will be issued in the fall of 1978 and will place all roadless land into three recommended categories:

1. Immediate classification as Wilderness

2. Those areas requiring further study

3. Areas that should be considered for uses other than wilderness

The candidate wilderness areas will be submitted to Congress for final determination of the areas to be incorporated into the National Wilderness Preservation System.

VII--REMAINING NEEDS

If national and local objectives for economic development are to be met, and if EQ preservation and enhancement desires for future timeframes are to be realized, then certain programs need to be accelerated or initiated and certain projects need to be installed. Remaining needs as defined in this chapter are those parts of the components of objectives identified in chapter III and quantified in chapter IV that will not be met by existing programs applied at current rates described in chapter VI. The component needs include items for future production of the basin's share of food and fiber, enhancement of environmental conditions, improvement of economic opportunity, and improvement of security from natural hazards.

The remaining needs include the following specific component items that were quantified in chapter IV, minus parts of the items that will be met by ongoing programs by 1990 as identified in chapter VI.

NATIONAL ECONOMIC DEVELOPMENT NEEDS

(1) In order to maintain a viable economy for the projected population, there is a need to preserve as much basic employment as possible in the renewable extractive industries of forestry and agriculture and a need to attract more basic industries employment. In order to offset declining employment in mineral products, forest products, and agricultural industries, the basin needs to generate over 7,350 full-time jobs in basic industries by 1990 and additional 10,000 man-years by 2020.

(3) About 90,000 acres of cropland now classed as types I and II wetland will still need drainage for improved efficiency of agricultural production by 1990.

(4) In order to maximize efficiency and production on 197,500 acres of presently irrigated land that will still be short of late-season water in 1990, there is a need to store 324,800 acre-feet of water.

(5) There will still be a need to improve municipal water systems for 20 communities.

(6) Rural recreation services on public land will not have been adequately provided by 1990. Remaining needed maintenance funding will be $1,135,000 per year above current funding. Remaining construction backlog will be $1,891,000 for facilities for 184 additional camper stalls at critically overused sites.

(9) Fishing access points will still be needed at 40 stream sites that will not be provided under current programs by 1990. Access to public land will still be needed at 19 sites.

(10) Boating access facilities will still be needed on 6 reservoirs and 5 white-water river sites.

(11) Additional land treatment to improve production and efficiency of resource use will still be needed on 109,130 acres of irrigated land and 1,560,000 acres of commercial forest. At present reported rates of application, all needed conversion to sprinkler irrigation will be complete and all range will be adequately managed. However, many land treatment practices are recurring and require continued management and maintenance.

(12) "Other" land treatment will still be needed on 56,000 acres by 1990.

(14) Based on current rates of subdivision, by 1990 an additional 47,000 acres of agricultural and forest land will have been subdivided. There is a need to maintain production on this resource base.

ENVIRONMENTAL QUALITY NEEDS

(15)(16) There will still be a need for control of erosion and sedimentation on 110,500 acres of dry cropland; 61,000 acres of forest land; 56,000 acres of other lands; 2,460 miles of trails, roads, and like areas; and 51 miles of streambanks by 1990. Many land treatment practices are recurring and require continued management and maintenance.

(17) Tertiary or nutrient removal sewage treatment facilities will still be needed for 21 communities by 1990, but will be completed by 2020. All 21 communities are expected to have secondary treatment by 1990. Industrial waste treatment facilities will be constructed by 1990.

(18) To control water pollution due to irrigation runoff, 109,130 more acres of irrigation water management will be needed by 1990.

(19) Reduced water fluctuations on 11 reservoirs for purposes of improving scenic beauty will be needed by 1990. These same sites will need control by 2020.

(20) About 79,000 acres of riparian vegetation along rivers and lakes will require protection by 1990.

(21) Additional access to national forest lands will still be needed at 19 sites that cannot be provided by ongoing program rates by 1990. Adequate access can be achieved by 2020.

(22) There will still be a need to protect open and green space by 1990. This need will continue into 2020.

(23) There will still be a need to protect 2,297 miles of free-flowing streams through 1990.

(24) Adequate minimum streamflows will be needed by 1990 on 2,484 miles of streams. These same streams will need to be protected through 2020.

(25) Water temperature and fluctuation control below Hungry Horse Dam will still be needed by 1990, but it is anticipated that these problems will be corrected by 2020.

(26) Because it is expected that the cost share monies for purchase or lease of wildlife habitat will be maintained at their present level, 1,300,000 acres of big game range; 13,600 acres of upland habitat; and 122,800 acres of wetland habitat will still need increased protection by 1990.

(27) Fish passage around existing blockage structures will still be needed in 1990. This problem could be corrected by 2020.

(28) The remaining need is to prevent the subdivision of wildlife habitat.

REMAINING COMMODITY NEEDS

Remaining commodity needs based on modified OBERS projected demands are shown in the following table. Chapter VIII will discuss the methods of meeting these remaining needs.

Commodity	Unit	Modified OBERS Projected Demands	To Be Met From Current Rate of Programs	Remaining Commodity Needs
1990:		- - - - - - - thousands - - - - - - -		
Wheat	Bu.	2,963	2,409	554
Oats	Bu.	490	616	0
Barley	Bu.	3,186	2,596	590
Hay	Tons	1,059	738	321
Pasture & Range forage	AUMs	1,816	1,816	0
Wood production	Cu.-Ft.	151,000	109,000	42,000
2020:				
Wood production	Cu.-Ft.	195,000	100,000	95,000

(9) Provide stream fishing access at 40 additional sites under accelerated acquisition by Montana Department of Fish and Game with assistance from Bureau of Outdoor Recreation and other agencies. Access to national forest land will be provided at 19 additional sites by Forest Service.

(10) Provide boat-launching ramps and floating docks by 1990 on six reservoirs that would not be so equipped under ongoing programs. Provide boat launching ramps at five white-water river sites.

(11) Accelerate land treatment to increase production and improve efficiency of resource use on 109,130 currently irrigated acres (this does not include new irrigation) and 1,150,000 acres of commercial forest.

(12) Accelerate land treatment to protect 56,000 acres of "other" land that would not be protected under current rates of ongoing programs.

(14) Stop subdivision of 47,000 acres of better quality agricultural and commercial forest land projected for subdivision by 1990.

ENVIRONMENTAL QUALITY PLAN

This EQ emphasis plan includes measures which could be developed for the preservation and enhancement of environmental conditions.

(15)(16) Accelerate land treatment to prevent erosion on 110,500 acres of dry cropland; 61,000 acres of forest land; 56,000 acres of "other" lands; and 2,460 miles of roads, trails, and 51 miles of streambanks. This will require additional funds and personnel.

(17) Increase funding for water pollution control. This would fund programs to:

(a) eliminate pollution from sewage from 21 communities' sewage systems by installing tertiary treatment facilities

(b) help eliminate pollution from other organic wastes such as from timber industries, roads, feedlots, etc.

(18) Accelerate conversion to sprinkler irrigation and improve other irrigation water management practices on 109,130 other irrigated acres to reduce pollution from return flows from irrigated lands. Accelerated technical and financial assistance would be required.

(19) Require all agencies and individuals to operate 11 reservoirs in such a manner that scenic beauty is maintained. There would be no large drawdowns at any time. This would require new laws and compensation for losses to the owners of these reservoirs.

(20) Provide 79,000 acres of setback or vegetative greenbelts along streams and lakeshores to help preserve water site beauty and riparian habitat for waterfowl, furbearers, and recreation. This protection of riparian vegetation will be accomplished by purchase of easements and strict zoning laws. Subdivision and cropland uses of these areas would be eliminated.

(21) Develop 19 additional general recreation access sites to public lands. Additional sites will help to alleviate the destruction of the present access sites due to overuse.

(22) Preserve natural beauty through:

(a) prohibiting mobile homes, outbuildings, and structures that are in discord with natural surroundings.

(b) placing a moratorium on further subdivision and an esthetic compliance code for new buildings and restricting construction to presently subdivided tracts.

(c) improving logging methods to reduce logging road construction, damage to unharvested timber, erosion, and production of sediment.

(d) reforesting cutover land.

(e) enforcing weed control laws to enhance rural beauty.

(f) prohibiting landowners from abusing their land by overgrazing, exposure to erosion, etc.

(23) Preserve 2,297 miles of class I through class IV streams which are presently in a free-flowing state. Prevent the building of any dams on any of the major streams.

(24) Provide sufficient minimum streamflows for aquatic habitat on 2,484 miles of class I through class IV streams by converting all irrigated lands to sprinkler irrigation and lining canals to reduce the total amount of water diverted for irrigation. Where the above methods still do not provide enough water for fish and wildlife, small water control structures would be built in the upper watershed of the stream.

(25) Construct a multiple level outlet structure at Hungry Horse Dam that would permit temperature control by drawing water from different depths in the reservoir. Construct a reregulating reservoir on the South Fork below Hungry Horse to reduce river fluctuations that are damaging trout and salmon spawning areas and other aquatic production.

(26) Acquire, lease, or manage 1,300,000 acres of wildlife habitat. Private lands which contain big game winter range will be either purchased or leased. Public land management agencies will designate all big game winter ranges as special areas to be managed to emphasize wildlife values. Domestic livestock grazing permits which occur in these big game winter range areas may be phased out as needed or management on them altered to enhance wildlife. Provide food and cover areas on 13,600 acres on and near agricultural lands for upland game. Preserve 122,800 acres of wetland areas for waterfowl habitat. Acquire, lease, manage, and enhance wetland types III and IV for waterfowl production.

(27) Provide fish passage around all present stream blockage structures. Prevent construction of any structure which blocks fish migration or passage.

(28) Stop subdivision of wildlife habitat.

Other

Limit the inclusion of presently proposed wilderness study areas into the wilderness system. Develop new categories for land protection which allow the majority of these study areas to be protected for wildlife habitat, rare or endangered plants, special scenic areas, etc. These new categories should provide for intensive management of the resource which is being protected.

Annual beneficial economic effects of plan element implementation were estimated from benefits observed in PL-566 watershed projects, RC&D project measures, cost/return studies, forest product economic studies, and input-output model studies. Annual adverse economic effects were estimated by amortizing total installation costs of plan elements by the Water Resources Council's discount rate for the appropriate length of life of each element and adding in appropriate operation and maintenance costs.

Tables VIII-1 and VIII-2 summarize the NED and EQ plans, their elements and effects as displayed to the four objective accounts. Table VIII-3 summarizes the effectiveness of the NED and EQ plans in meeting the needs identified in chapter VII. Adverse NED and RD effects in these tables are annualized costs of development plus increased annual O&M costs.

EFFECTIVENESS OF LAND TREATMENT TO MEET PROJECTED COMMODITY NEEDS

The following is a comparison of annual commodity demand as projected by OBERS and production that can be expected from current rates of land treatment and from accelerated land treatment. The remaining agricultural commodity needs might be met from additional irrigation development or from other production-increasing means if OBERS projected demands were to be

satisfied. These increased commodities could be produced by converting about 107,000 acres of dry cropland to new irrigation and use an added 267,000 acre-feet of irrigation water by 1990. An alternative would be to supply the late-season water needed by crop and pasture lands now short of late-season water.

COMMODITY NEEDS TO MEET MODIFIED OBERS PROJECTIONS

Commodity	Unit	Modified OBERS Projected Demand	To Be Met From Current Rates of Land Treatment	To Be Met From Accelerated Land Treatment	Remaining Commodity Demand
		- - - - - - - - - - Thousands - - - - - - - - - -			
1990					
Wheat	Bu.	2,963	2,409	121	433
Feed grains	Bu.	3,676	3,212	155	309
Hay	Tons	1,059	738	71	250
Pasture & range forage	AUMs	1,816	1,816	0	0
Wood production	Cu.-Ft	151,000	109,000	23,000	19,000

TABLE VIII-1--NED ALTERNATIVE PLAN - OBERS EMPHASIS--Annual Effects As Compared With the Future Without Planning Situation Estimate

CLARK FORK OF THE COLUMBIA RIVER BASIN

Plan Elements	Economic Development Account		Environmental Quality Account		Regional Development Account				Social Well Being Account	
					Beneficial Effects		Adverse Effects			
	Beneficial Effects	Adverse Effects	Beneficial Effects	Adverse Effects	To the Basin	Rest of Nation	To the Basin	Rest of Nation	Beneficial Effects	Adverse Effects
	- - $1,000 - - -				- - - - - - $1,000 - - - - - -					
(1) Attract new basic industry for 6,152 new jobs.	36,900	30,600	---	Land, energy, & construction materials required.	36,900	---	30,600	---	Maintain level of employment and standard of living.	Population growth as expected.
(3) Drain 90,000 acres of types I & II wetland cropland to increase hay production 270,000 tons per year.	5,000	2,500	Some improved habitat for upland birds.	Reduced habitat for waterfowl.	5,000	---	1,250	1,250	Increased farm income. Decreased mosquitoes.	---
(4) Store 16,030 acre-feet of supplemental water for 14,740 acres now short of late-season water. Four new multipurpose reservoirs.	1,072	489	Increased late-season instream flows where natural streams carry the irrigation water.	Reduced instream water flows except where natural streams are used to carry the irrigation water. Loss of four miles of free-flowing stream. Same as in 1. above.	1,072	---	260	229	Increase incomes and improve economic stability of existing farms and agri-business.	---
(5) Improve municipal water systems for 20 communities.	750	750	Minor, depending on type of system.	Land, energy, and materials required.	750	---	400	350	Safe drinking water without sediment or unpleasant odors and with adequate supplies for fire fighting.	

TABLE VIII-1--NED ALTERNATIVE PLAN - OBERS EMPHASIS--Annual Effects As Compared With the Future Without Planning Situation Estimate (continued)

Plan Elements	Economic Development Account		Environmental Quality Account		Regional Development Account				Social Well Being Account	
					Beneficial Effects		Adverse Effects			
	Beneficial Effects	Adverse Effects	Beneficial Effects	Adverse Effects	To the Basin	Rest of Nation	To the Basin	Rest of Nation	Beneficial Effects	Adverse Effects
	- - - $1,000 - - -				- - - - - - - $1,000 - - - - - - -					
(6) Provide recreational services & maintenance on public land.	1,420	1,135	Reduced pollution at high-use recreation sites.	Land, energy, & materials required.	250	1,170	---	1,135	Higher quality and safer facilities.	---
Facilities construction	160	126			35	125	6	120		
(9) 40 additional fishing access sites. 19 additional access sites to national forest land.	260	208	Reduce congestion, traffic, & pollution at access sites.	Encourages more use of public land generally. More public use & pollution of streams & lakes. Minor loss of wildlife habitat.	55	205	35	173	Less congestion of recreationists. Reduced trespass.	
(10) Boat launching ramps & docks for 6 reservoirs.	45	36	Reduced erosion at boat launching sites.	More pollution of reservoirs by fuels, oils, etc.	35	10	18	18	More even distribution of boats and improved safety.	More noise, traffic, and waves on reservoirs.
(11) Accelerate land treatment to improve production on 109,130 irrigated acres and 1,150,000 acres commercial forest.	820	460	Reduced erosion & sedimentation. Increased terrestrial wildlife. Reduced nonpoint stream pollution. Improved visual esthetics.	Consumption of energy and materials. Some increased erosion on forest management roads.	820	---	230	230	Increased income, improved economic stability, and maintained agriculture and forestry.	---
	35,700	31,000			11,700	24,000	1,500	29,500	1,000 jobs by 1990	
(12) Accelerate land treatment on 56,000 acres "other" land.	680	670	Same as in 11. above.	Minor consumption of energy and materials.	680	---	340	330	Maintain property values.	---
(14) Halt subdivision of better agricultural and forested lands.	460	250	Preserve wildlife habitat.	Increase building on existing subdivisions.	460	---	250	---	Maintain economic resource base.	---
Total Effects	83,267	68,224			57,757	25,510	34,889	33,335		

TABLE VIII-2--EQ ALTERNATIVE PLAN--Annual Effects As Compared With the Future Without Planning Situation Estimate

CLARK FORK OF THE COLUMBIA RIVER BASIN

Plan Elements	Economic Development Account	Environmental Quality Account		Regional Development Account		Social Well Being Account	
				Adverse Effects			
	Adverse Effects	Beneficial Effects	Adverse Effects	To the Basin	Rest of Nation	Beneficial Effects	Adverse Effects
	- - - $1,000 - - -			- - - - - - $1,000 - - - - - -			
(15)(16) Accelerate land treatment to prevent erosion on 110,500 ac. dry cropland; 61,000 ac. forest; 56,000 ac. "other" land; and 2,460 miles of roads, trails, and streambanks.	272 894 670 402	Reduced erosion & sediment; reduced dust in the air; improved vegetation & wildlife habitat; improved visual esthetics.	Energy and materials required.	136 48 340 20	136 846 330 382	Increased satisfaction & pride in the area; increased economic stability.	---
(17) Increased water pollution abatement to reduce heavy metals, acids, sewage, salts, and other organic wastes in streams.	750	Protected and improved aquatic habitat & improved health for people and animals.	Energy, land, & materials required.	400	350	Reduced hazards to health.	Possible loss of jobs.
(18) Accelerate conversion to sprinkler irrigation on presently irrigated land.	(460)	Reduced diversion of water, irrigation return flows, and associated nonpoint source pollution.	Reduced small wetland areas; increased energy requirements.	(310)	(150)	Increased and stabilized farm incomes.	---
(19) Operate 11 reservoirs with negligible drawdown.	19,000	Improved reservoir fishery and esthetics.	Reduced late-season instream flows; reduced feeding areas for shorebirds.	19,000	---	Improved quality of recreation on reservoirs.	Reduced farm income, industrial income, & employment; less stable economy.
(20) Provide protected and managed vegetative setback areas along streams and lakes.	2,800	Improved aquatic & riparian habitat; improved visual quality & reduced erosion.	Minor reduction of summer season instream flows.	---	2,800	Improved quality of recreation; reduced property loss.	More mosquitoes. Reduced property values of riparian lands.

TABLE VIII-2--EQ ALTERNATIVE PLAN -Annual Effects As Compared With the Future Without Planning Situation Estimate (continued)

Plan Elements	Economic Development Account	Environmental Quality Account		Regional Development Account		Social Well Being Account	
	Adverse Effects	Beneficial Effects	Adverse Effects	Adverse Effects To the Basin	Adverse Effects Rest of Nation	Beneficial Effects	Adverse Effects
	- - - $1,000 - - -			- - - - - - $1,000 - - - - - -			
(21) Develop 19 additional access sites to national forest lands.	138	Reduced destruction of vegetation & wildlife habitat around existing access sites.	Wider distribution of litter & loss of some wildlife habitat for construction of new sites.	7	131	Less frequent trespass; improved quality of recreation.	---
(22) Preserve natural beauty		quality; reduced litter.					
a. Prohibit location or construction of mobile homes, outbuildings, and structures not in harmony with natural surroundings.	200			200	---	Improved utility service.	Reduced individual freedom of use of land, legally very difficult.
b. Discontinue subdivision & restrict building construction to presently subdivided tracts.	(250)	Protected visual quality; preserved habitat for big game animals.	More & larger buildings on presently subdivided land.	(250)	---	Improved utility service.	Same as for 22, Land now subdivided & available for buildings would become too expensive for average individual family dwellings and more apartment buildings would be built.

TABLE VIII-2--EQ ALTERNATIVE PLAN--Annual Effects As Compared With the Future Without Planning Situation Estimate (continued)

Plan Elements	Economic Development Account	Environmental Quality Account		Regional Development Account		Social Well Being Account	
	Adverse Effects	Beneficial Effects	Adverse Effects	Adverse Effects To the Basin	Adverse Effects Rest of Nation	Beneficial Effects	Adverse Effects
	- - - $1,000 - - -			- - - - - - $1,000 - - - - - -			
(22) (continued)							
c. Use logging methods requiring fewer roads, preventing erosion, reducing damage to unharvested trees, & using irregular harvest patterns.	22,000	Reduced erosion & visual impact of logging; improved big game habitat, vegetation & forest production; reduced pollution from motorized vehicles.	Some effects of logging would remain.	21,000	1,000	Timber would remain available as a building material.	Less motorized access to timbered areas. Reduced employment.
d. Reforest cutover land & manage stand growth for balanced timber & wildlife systems.	2,730	Improve vegetation, big game habitat, and visual quality.	---	1,365	1,365	Stabilize forest economy; increase real income.	---
e. Enforce weed control laws.	200	Improve visual quality.	Reduce bird habitat; introduce more herbicides into natural environment.	200	---	Increased satisfaction and pride in area and increased economic stability.	---
f. Prohibit landowners from abusing land by overgrazing, erosion, etc.	200	Reduced erosion; improved visual quality, wildlife habitat, vegetation, and open and green space.		200	---	---	Limited freedom of use of land; legal problems.
(23) Preserve all perennial streams in present free-flowing state.		Preserve aquatic habitat & maintain visual quality.	Continue with low late-summer streamflows.			---	Reduced real income.

TABLE VIII-2--EQ ALTERNATIVE PLAN -Annual Effects As Compared With the Future Without Planning Situation Estimate (continued)

Plan Elements	Economic Development Account	Environmental Quality Account		Regional Development Account		Social Well Being Account	
	Adverse Effects	Beneficial Effects	Adverse Effects	Adverse Effects To the Basin	Adverse Effects Rest of Nation	Beneficial Effects	Adverse Effects
	- - - $1,000 - - -			- - - - - - $1.000 - - - - - -			
(24) Provide sufficient instream flows for aquatic habitat a. Reserve instream flows. b. Construct small headwater reservoirs. c. Line irrigation canals to reduce seepage and irrigation diversion requirements.	3,000	Maintain & enhance aquatic life with improved instream flows.	Some small wetland areas would be reduced; materials and energy required.	3,000	---	Reduced additional irrigation development.	
(25) Construct multilevel outlet structure and reregulating reservoir for Hungry Horse dam.	4,400	Improved downstream water temperatures & reduced diurnal flow fluctuations for improved aquatic habitat in Flathead River.	Large amounts of material and energy required.	---	4,400	River access & use would be safer. Some added electric power.	---
(26) a. Acquire, lease, or manage 1,000,000 ac. wildlife habitat. Domestic livestock grazing permits on public lands in big game winter range areas may be phased out as needed or management altered to enhance wildlife.	4,000	Improved vegetative & big game habitat; reduced erosion.	Negligible	4,000	---		Reduced real income.
b. Provide food & cover areas for upland game on agricultural land.	240	Improved wildlife habitat & reduced erosion.	Negligible	120	120		Reduced farm income.

TABLE VIII-2--EQ ALTERNATIVE PLAN--Annual Effects As Compared With the Future Without Planning Situation Estimate (continued)

Plan Elements	Economic Development Account	Environmental Quality Account		Regional Development Account		Social Well Being Account	
				Adverse Effects			
	Adverse Effects	Beneficial Effects	Adverse Effects	To the Basin	Rest of Nation	Beneficial Effects	Adverse Effects
	- - - $1,000 - - -			- - - - - - $1,000 - - - - - -			
(26) (continued) c. Preserve all wetland areas not already drained (124,700 acres) for waterfowl habitat. Acquire, lease, & manage all types III & IV wetland.	1,247	Increased population of waterfowl & other animals.	Negligible	624	623		Reduced farm income & more mosquitoes.
(27) Provide fish passage around all present stream blockages & prevent any future artificial blockage.	25	Enlarge fish populations.	Energy and materials required.	25	---	Minor secondary employment; increased recreational use of fishery.	---
(28) Stop subdivision of wildlife habitat.	(250)	Maintain habitat.	---	(250)	---	Maintain rural setting.	More expensive building lots & more crowding
TOTAL EFFECTS	63,418			50,935	12,483		

TABLE VIII-3--ALTERNATIVE PLAN EFFECTIVENESS IN SATISFYING NEEDS

Clark Fork of the Columbia River Basin

ALTERNATIVE PLAN and PLAN ELEMENTS (Early Action)	PLAN EFFECTIVENESS			
	Units	Identified Needs From Chap. VII	Plan Provides	Remaining Unmet Needs
NED PLAN: (1990)				
(1) Additional basic industry employment	Nos. full time jobs	7,350	7,270	80
(3) Drainage of cropland with high water table	Acres	90,000	90,000	None
(4) Store early runoff water for late summer irrigation on acres now short of late season water.	Acre-feet Acres	324,800 197,500	19,730 11,560	305,070 185,940
(5) Improve municipal water supply systems	Nos. of towns	20	20	None
(6) Need added funding for recreational services on public land and added camping stalls at over-used sites	$1,000/yr. Camp stalls	1,135 184	1,135 184	None None
(9) Additional access sites to public lands to fishing streams	Nos. sites Nos. sites	19 40	19 40	None None
(10) Boating access facilities on fluctuating reservoirs	Nos. sites	6	6	None
(11) Land treatment acceleration to improve production and efficiency of resource use. Irrigated land Commercial forest	 Acres Acres	 109,130 1,560,000	 109,130 1,150,000	 None 410,000
(12) Land treatment to preserve use of "other" land	Acres	56,000	56,000	None

TABLE VIII-3--ALTERNATIVE PLAN EFFECTIVENESS IN SATISFYING NEEDS (continued)

ALTERNATIVE PLAN and PLAN ELEMENTS (Early Action)	PLAN EFFECTIVENESS			
	Units	Identified Needs From Chap. VII	Plan Provides	Remaining Unmet Needs
NED PLAN: (1990) (contd)				
(14) Preserve present use of better cropland and commercial forest.	Acres	47,000	47,000	None
COMMODITY NEEDS				
Wheat	Bu.	554	54	500
Barley	Bu.	590	65	525
Hay	Tons	321	69	252
Wood production	Cu.-Ft.	42,000	23,000	19,000
EQ PLAN: (1990)				
(15)(16) Erosion and sediment control:				
Cropland	Acres	110,500	110,500	None
Forest land	Acres	61,000	61,000	None
Other land	Acres	56,000	56,000	None
Trails and roads	Miles	2,460	2,460	None
Streambanks	Miles	51	51	None
(17) Tertiary sewage treatment	Towns	21	21	None
(18) Control irrigation return flows	Acres	109,130	109,130	None
(19) Reduced fluctuation on reservoirs	Nos. Reservoirs	11	11	None
(20) Protect riparian vegetation	Acres	79,000	79,000	(Continuing)
(21) Additional access sites to National Forest	Nos. sites	19	19	None
(22) Protect open and green space natural beauty	Acres	All	All	(Continuing)

TABLE VIII-3--ALTERNATIVE PLAN EFFECTIVENESS IN SATISFYING NEEDS (continued)

ALTERNATIVE PLAN and PLAN ELEMENTS (Early Action)	PLAN EFFECTIVENESS			
	Units	Identified Needs From Chap. VII	Plan Provides	Remaining Unmet Needs
EQ PLAN (1990) (contd)				
(23) Protect free-flowing streams	Miles	2,297	2,297	None (Continuing)
(24) Provide minimum streamflows	Miles	2,484	2,484	None (Continuing)
(25) Control water temperature and flow fluctuations below Hungry Horse Reservoir	Reservoir Re-reg. & outlet	1 1	1 1	None None
(26) Preserve wildlife habitat				
Big game range	Acres	1,300,000	1,300,000	(Continuing)
Upland game	Acres	13,600	13,600	(Continuing)
Wetlands	Acres	122,800	122,800	(Continuing)
(27) Fish passage around blockage structures	Nos.	All	All	(Continuing)
(28) Protect wildlife habitat from subdivision	Projected Acres	47,000	47,000	None (Continuing)

IX. PREFERRED PLAN

Chapter VIII presented an NED alternative plan emphasizing modified OBERS economic level C projections and a plan to emphasize environmental quality. None of those plans presents the best mix of plan elements for improved quality of living or to satisfy the desires of the majority of the public which is concerned with the basin. Selected elements of each of the two plans in chapter VIII are combined in this chapter to develop a preferred plan acceptable to the majority of the public.

The Montana Department of Natural Resources and Conservation identified 1,200,000 acres of arable soils in the basin that have characteristics suitable for irrigation. Some of this land was included in areas evaluated during watershed investigation analyses, but much of it was not. As the sponsoring agency, the MDNR&C would like to have these lands evaluated for feasibility and impacts under a cooperative special study similar to one now under way in the Upper Missouri River Basin in Montana.

HOW THE PLAN WAS SELECTED

In the recommended compromise plan there are areas of complementarity in which both economic development and environmental quality are improved through resource development. Conversely, there are areas where development for one objective or component decreases the satisfaction of another objective or component. These are the areas in which tradeoffs were identified and plan elements were changed or deleted in order to develop the preferred plan.

Elements of the NED and EQ emphasis plans which can be complementary include:

-- moratorium on subdivision of good agricultural and commercial forest land while land use planning techniques are being perfected

-- storage of excess spring runoff for later season use to provide ample water for both irrigation and fish and wildlife

-- reduction of some forms of pollution

-- acceleration of land treatment measures that preserve and enhance resources for long-term use, particularly sprinkler irrigation and improved timber management, harvest, and reforestation.

Elements of the NED and EQ plans which are in conflict include:

-- attract new manufacturing industry for about 6,152 new basic jobs and associated increased population growth versus water pollution abatement.

-- draining cropland in types I and II wetland conflicts with preserving all wetland areas for waterfowl habitat.

-- boat launching ramps and docks and associated recreational activity versus water pollution abatement.

-- more complete manufacture of wood products and associated increased population growth versus water pollution abatement.

-- more hydroelectric power after 1990 versus preserve all perennial streams in present free-flowing state and operate all reservoirs with negligible fluctuation.

-- line canals and increase sprinkler irrigation versus preserve all wetland areas for waterfowl habitat.

-- store supplemental irrigation water and more hydroelectric power after 1990 versus nominate, preserve, protect, and develop archeological, cultural, and historical sites.

-- that part of land treatment emphasizing agricultural production versus providing food and cover areas for upland game on agricultural land.

A few environmental elements were neutral to NED elements except for NED costs.

A public involvement draft of this report, which included only the alternative plans shown in chapter VIII, was presented for public and agency review in the fall of 1976. The public responses to that draft were interpreted by a study team made up of USDA and State personnel into the following preferred plan.

PREFERRED PLAN

In the preferred plan it is recognized that the study team plans for the social and cultural well-being of people. Success of a plan depends on the ability of residents to earn a satisfactory living in a pleasing environment.

NED ELEMENTS

The following NED plan elements are included in the preferred early action plan to be accomplished by 1990.

(1) Provide more manufacturing for export and more services to people from outside the basin in order to sustain basic employment for the present population and increase basic employment by about 6,152 jobs for the

increased population anticipated. Programs of government and private industry would be directed toward attracting new basic industry to the basin.

(3) Install drains on about 12,800 acres of cropland now classed as types I and II wetlands which are not adjacent to types III and IV wetlands, with a resulting increase of 38,000 tons of hay. The remaining 77,200 acres of cropland now classed as types I and II wetlands were found to be adjacent to types III and IV wetland and were reserved from drainage.

(4) Store 28,000 acre-feet of excess spring runoff water in three reservoirs (Browns Gulch, Lower Willow, and Rattlesnake) and two lake storages (Whitefish and Stillwater) for late-season irrigation of presently irrigated land, streamflow augmentation, municipal water supply, and incidental flood reduction benefits. About 19,730 acre-feet would improve irrigation on 11,560 irrigated acres.

(5) Improve municipal water systems for 20 towns through improved water quality, supply, and distribution systems.

(6) Provide an increase of $1,135,000 per year from Forest Service funding for recreational services maintenance and $1,891,000 of construction funds to build facilities for 184 camper units at critically overused sites on the national forests.

(9) Acquire fishing access at 40 stream sites and general recreation public land access at 19 additional locations on national forests.

(10) Provide a boat launching ramp and a floating dock on each of six reservoirs and boat ramps at five white-water river sites.

(11) Accelerate land treatment to increase production on 109,130 currently irrigated acres and 1,150,000 acres of commercial forest.

(12) Accelerate land treatment to protect 56,000 acres of "other" lands from erosion.

(14) Declare a moratorium on subdividing quality agricultural and commercial forested lands until existing subdivided tracts are occupied unless specific need can be shown.

EQ ELEMENTS

Environmental Quality plan elements included in the preferred early action plan for 1990 include the following.

(15)(16) Accelerate technical and financial assistance to eliminate erosion and sediment production on 110,500 acres of dry cropland; 61,000 acres of

forest land; 56,000 acres of other lands; 51 miles of streambanks; and 2,460 miles of roads and trails.

(17) Provide technical and financial assistance for tertiary sewage treatment for 21 towns to control water pollution.

(18) Accelerate conversion to sprinkler irrigation and improve other irrigation water management practices on 109,130 other irrigated acres to reduce pollution from return flows from irrigated lands. Accelerated technical and financial assistance would be required.

(19) Operate reservoirs, within practical limits, to minimize drawdown and exposure of mudflats during the summer.

(20) Protect riparian vegetation on 79,000 acres along streams and lakeshores under easements, acquisition, and zoning programs.

(21) Provide 19 additional access sites to public lands and secure legal rights-of-way for existing accesses.

(22) Preserve and protect present open and green space through legislation that would require an esthetic compliance code for new buildings, improved logging methods and esthetic harvest of timber, and careful design and construction of roads and utility lines to harmonize with natural beauty of the area.

(23) Preserve 1,123 miles of fishery class 1, 2, and 3 streams in their free-flowing state under wild and scenic river designations. Through 1990, new hydroelectric power development would be limited to Buffalo Rapids units 2 and 4.

(24) Reserve minimum streamflows for 2,484 miles of live streams using a modified version of the "Montana Method." That modified method would not require minimum flows in excess of the natural low level base flow, not subject to diversion, as determined by an average of measured flows from September 30 through March 31 for the years of record. Provide legislation and appropriations so that owners of water rights for irrigation would be indemnified from public funds for loss of production due to meeting minimum flow requirements. Conversely, provide legislation so that all irrigation water users would be required to use all economically feasible means to improve their irrigation efficiencies.

(25) Build a reregulating dam on the South Fork of Flathead River below Hungry Horse Reservoir to reduce the fluctuations in flows and temperatures from the reservoir.

(26) Manage wildlife habitat for wildlife. Purchase, lease, or arrive at management agreements on about 66,000 acres of private big game range as

determined by severe winters. (See map IV-1) Public land management agencies will designate approximately 117,000 acres of critical big game range as determined by severe winters (see map IV-1) as special areas to be managed to emphasize wildlife values. Since these critical areas comprise only about one-half of one percent of the total animal unit months of grazing for the basin, it is felt that very little adverse economic impact will result from this recommendation. Purchase, lease, or arrive at management agreements on maintaining 105,200 acres of wetlands for wildlife habitat. Food and cover areas on 9,700 acres on and near agricultural lands will be provided for upland game by technical assistance, lease, acquisition, or management programs.

(27) Improve fish passage around Big Fork dam and through any obstructing culverts or bridges now in place. Install new construction in such a manner as to ensure adequate fish passage.

(28) Stop subdivision of wildlife habitat, particularly in riparian and forest fringe areas or require mitigation for lost habitat.

TABLE IX-1--COMPARISON OF ALTERNATIVE PLANS

CLARK FORK OF THE COLUMBIA RIVER BASIN

Account Plan Element and Effects	Difference of Preferred-- vs NED Plan	NED Plan	Preferred Plan	EQ Plan	Difference of Preferred-- vs EQ Plan
		- - - - - - - - - - - Thousands Dollars - - - - - - - - - - -			
I. National Economic Development (Annual Benefits and Costs)					
(1) Additional Basic Industry					
Benefits	None	36,900	36,900	None	36,900
Costs	None	30,600	30,600	None	+ 30,600
(3) Drainage of Cropland					
Benefits	- 4,240	5,000	760	None	+ 760
Costs	- 2,152	2,500	348	None	+ 348
(4) Storage for Irrigation					
Benefits	None	1,072	1,072	None	+ 1,072
Costs	None	489	489	None	+ 489
(5) Improve M&I Water Systems					
Benefits	None	750	750+	None	+ 750
Costs	None	750	750	None	+ 750
(6) Recreation Funding & Camp. Stalls					
Benefits	None	1,580	1,580	None	+ 1,580
Costs	None	1,261	1,261	None	+ 1,261
(9) Additional Access Sites					
Benefits	None	260	260	None	+ 260
Costs	None	208	208	None	+ 208
(10) Boating Access Facilities					
Benefits	None	45	45	None	+ 45
Costs	None	36	36	None	+ 36

TABLE IX-1--COMPARISON OF ALTERNATIVE PLANS
CLARK FORK OF THE COLUMBIA RIVER BASIN

Account Plan Element and Effects	Difference of Preferred-- vs NED Plan	NED Plan	Preferred Plan	EQ Plan	Difference of Preferred-- vs EQ Plan
I. NED (continued)	- - - - - - - - - - - - Thousands of Dollars - - - - - - - - - - - -				
(11) Land Treat. Acceleration					
Benefits	None	36,520	36,520	None	+ 36,520
Costs	None	31,460	31,460	None	+ 31,460
(12) Land Treat. Other Lands					
Benefits	None	680	680	None	+ 680
Costs	None	670	670	None	+ 670
(14) Preserve Present Land Use					
Benefits	None	460	460	None	+ 460
Costs	None	250	250	None	+ 250
(15)(16) Erosion & Sediment Control					
Costs	+ 2,238	None	2,238	2,238	None
(17) Tertiary Sewage Treatment					
Costs	+ 750	None	750	750	None
(18) Control Irrig. Return Flows (Included in item 11)					
Costs	(+ 460)	None	(460)	(460+)	None
(19) Reduced Reservoir Fluctuations					
Costs	None	None	Nil	19,000	- 19,000
(20) Protect Riparian Vegetation					
Costs	+ 2,800	None	2,800	2,800	None

TABLE IX-1--COMPARISON OF ALTERNATIVE PLANS (continued)
CLARK FORK OF THE COLUMBIA RIVER BASIN

Account Plan Element and Effects	Difference of Preferred-- vs NED Plan	NED Plan	Preferred Plan	EQ Plan	Difference of Preferred-- vs EQ Plan
I. NED (continued)	- - - - - - - - - - - - - - Thousands of Dollars - - - - - - - - - - - - - -				
(21) Additional Access fo N.F.					
Costs	+ 138	None	138	138	None
(22) Protect Natural Beauty					
Costs	+25,580	None	25,580	25,580	None
(23) Protect Free-flowing Streams					
Costs	None	None	Nil	Nil	None
(24) Provide Minimum Streamflows					
Costs	+ 3,300	None	3,000	3,000	None
(25) Hungry Horse Temperature & Flow					
Costs	+ 1,600	None	1,600	4,400	- 2,800
(26) Preserve Wildlife Habitat					
Costs	+ 834	None	834	5,487	- 4,653
(27) Fish Passage Around Structures					
Costs	+ 25	None	25	25	None
(28) Protect Against Subdivision (Included in item 14)					
Costs	(+ 250)	None	(250)	(250)	None
TOTAL PLAN 1/					
Benefits	- 4,240	83,267	79,027	None	+ 79,027
Costs	34,813	68,224	103,037	63,418	+ 39,619

1/ (Some NED & EQ Duplication not added in.)

TABLE IX-1--COMPARISON OF ALTERNATIVE PLANS (continued)
CLARK FORK OF THE COLUMBIA RIVER BASIN

Account and Effects	Difference of Preferred-- vs NED Plan	NED Plan	Preferred Plan	EQ Plan	Difference of Preferred-- vs EQ Plan
II. Environmental Quality	- - - - - - - - - - - - - - - - Units As Shown - - - - - - - - - - - - - - - -				
Beneficial and Adverse Effects					
A. Preservation of Natural Beauty					
1. New lakes (surface acres)	None	1,085	1,085	None	+ 1,085
2. Protected rivers (miles)	+ 1,342	None	1,342	2,416	- 1,074
3. Protected riparian land (acres)	+ 79,000	None	79,000	79,000	None
4. Ag land to wildlife land (acres)	+ 9,700	None	9,700	9,700	None
B. Biological & Ecological Systems					
1. Wetland habitat (acres)	+ 77,200	28,000	105,200	118,000	- 12,800
2. Upland habitat (acres)	+ 9,700	None	9,700	9,700	None
3. Winter game range (acres)	+183,000	None	183,000	1,301,000	-1,118,000
4. Minimum streamflow (miles)	+ 2,500	None	2,500	2,500	None
5. Improved spawning stream (miles)	+ 18	68	86	18	+ 68
C. Quality of Water & Land Resources					
1. Reduced erosion (acres)	+227,500	None	227,500	227,500	None
2. Reduced road & trail eros.(mi.)	+ 2,460	None	2,460	2,460	None
3. Reduced stream erosion (mi.)	+ 51	None	51	51	None
4. Tertiary treatment of sewage(towns)	+ 21	None	21	21	None
5. Reduced irrig. return flows(acres)	+109,130	None	109,130	109,130	None
6. Temperature fluctuations (miles)	+ 40	None	40	40	None
D. Irreversible Commitments					
1. Streams into reservoirs (miles)	None	5	5	None	+ 5
2. Habitat into reservoirs (acres)	None	1,085	1,085	None	+ 1,085
3. Stream depletion (percent)					
Flathead River	None	0.25	0.25	None	+ 0.25
Whitefish River	None	1.0	1.0	None	+ 1.0
Stillwater River	None	2.5	2.5	None	+ 2.5

TABLE IX-1--COMPARISON OF ALTERNATIVE PLANS (continued)
CLARK FORK OF THE COLUMBIA RIVER BASIN

Account and Effects	Difference of Preferred-- vs NED Plan	NED Plan	Preferred Plan	EQ Plan	Difference of Preferred-- vs EQ Plan
III. Regional Development			Thousands of Dollars		
A. Primary Value to Users					
1. Basic industry	None	36,900	36,900	None	+36,900
2. Ag. production	- 4,240	6,892	2,652	None	+ 2,652
3. Forest production	None	35,700	35,700	None	+35,700
4. M&I water	None	750	750	None	+ 750
5. Recreation	None	1,885	1,885	None	+ 1,885
6. Resource preservation	None	1,140	1,140	None	+ 1,140
Total Primary	- 4,240	83,267	79,027	None	+79,027
B. Secondary Income Value to Basin					
1. Basic industry	None	36,900	36,900	None	+36,900
2. Ag. production	- 4,240	6,892	2,652	None	+ 2,652
3. Forest production	None	35,700	35,700	None	+35,700
4. M&I water	None	None	None	None	None
5. Recreation	None	128	128	None	+ 128
6. Resource preservation	None	460	460	None	+ 460
7. Environmental installation	+ 12,633	None	12,633	12,633	None
Total Secondary	+ 8,393	80,080	88,473	12,633	75,840
C. Net New Full-Time Jobs			Units As Shown		
1. Irrigation	None	6	6	None	6
2. Drainage	None	12	12	None	12
3. Forestry	None	1,000	1,000	None	1,000
4. Recreation	None	100	100	None	100
5. Erosion control	+ 80	None	80	80	None
6. New manufacturing	None	6,152	6,152	None	6,152
Total New Jobs	80	7,270	7,350	80	7,270
D. Regional Economic Base					
1. Dryland to irrig. (acres)	None	6,260	6,260	None	+ 6,260
2. Supplemental irr. water (ac-ft)	None	19,730	19,730	None	+ 19,730
3. Drain wet cropland (acres)	- 77,200	90,000	12,800	None	+ 12,800
4. Improve forest prod. (acres)	None	1,150,000	1,150,000	None	+ 1,150,000

TABLE IX-1--COMPARISON OF ALTERNATIVE PLANS (continued)
CLARK FORK OF THE COLUMBIA RIVER BASIN

Account and Effects	Difference of Preferred-- vs NED Plan	NED Plan	Preferred Plan	EQ Plan	Difference of Preferred-- vs NED Plan
III. R. D. (continued)	- - - - - - - - - - - - - - Units As Shown - - - - - - - - - - - - - -				
E. Total Plan (1,000 Dollars)					
1. Federal cost (annual)	+ 7,864	33,335	41,199	12,483	+ 28,716
2. Regional cost (annual)	+ 26,949	34,889	61,838	50,935	+ 10,903
3. Total cost (annual)	+ 34,813	68,224	103,037	63,418	+ 39,619
IV. Social Well Being					
A. Life, Health, and Safety					
Improved water quality (miles)	+ 18	68	86	58	28
B. Recreational Opportunities					
New fishing access (sites)	None	40	40	None	+ 40
New public land access (sites)	None	19	19	19	None
New boating access (sites)	None	6	6	None	+ 6
Improved stream flows (miles)	+ 58	68	126	98	+ 28
Improved recreation quality	None	Basin-wide	Basin-wide	Basin-wide	None

Note: Nil means immeasurable small amount; none means zero.

TABLE IX-2--SUMMARY OF PRINCIPAL ANNUAL EFFECTS OF IMPLEMENTING PREFERRED PLAN ELEMENTS
CLARK FORK OF THE COLUMBIA RIVER BASIN

Plan Elements	Plan Items Involved	Increased Annual Commodity Production, etc.	National Economic Development Effects (Annual) Beneficial/Adverse		Environmental Quality Beneficial/Adverse Effects	Regional Development Effects (Annual) Beneficial/Adverse		Social Well Being Beneficial/Adverse Effects	Agencies & Programs Involved
		Quantity/Units	- - - $1,000 - - -			- - - - $1,000 - - -			
Provide 6,152 more basic employment jobs by 1990 (above those from USDA programs)	NED: (1) EQ: (17, 20 22,28)	Diverse	36,900	30,600	Continued population pressure on wildlife habitat & natural resources. Land, energy, materials used.	73,800	30,600	Sound, viable economy with adequate employment for existing and 1990 population.	SCS, FS, State, local RCD, RAO, private.
Drainage & management of wetlands.	NED:(3) EQ:(20,26)	38,000 T/hay equiv. Increased waterfowl	760	348 1,119	Minor loss of habitat on hayland. Increased waterfowl on preserved lands.	1,520	174 1,119	12 man-years employment; some increased hunting; increased farm income.	SCS, F&G, F&WS, private.
Storage of 28,000 acre-feet of surplus spring runoff for late-season irrigation, power, municipal, & streamflow augmentation uses.	NED:(4,5) EQ:(19,23,24)	(2T hay equiv. per ac/ft delivered to field.) Some power, municipal, & F&W water.	1,072	489	Loss of some stream habitat. Gain some late-season instream flows. Land, energy, materials used.	2,144	436	Increased incomes and economic stability	State, private
Improve municipal water & sewer systems.	NED:(5) EQ:(17)	NA	750 ---	750 750	Minor change on water systems; major improvement on sewer systems.	750 ---	375 375	Safe, reliable water supply; reduced hazards to health on sewage disposal.	FmHA, HUD, State, local government, and EPA
Provide recreation opportunity to match demand.	NED:(6,7,10) EQ:(15,16,19, 20,21,23,24, 25,26,27,28	Doubled recreation management services; 184 camper stalls at critical sites.	1,885	1,505	Reduced pollution at high-use sites.	2,013	115	Well-balanced high quality recreation; 100 man-years employment.	FS, F&G, BOR, SCS, PL-566, RC&D, local & private government

TABLE IX-2--SUMMARY OF PRINCIPAL ANNUAL EFFECTS OF IMPLEMENTING PREFERRED PLAN ELEMENTS (Continued)
CLARK FORK OF THE COLUMBIA RIVER BASIN

Plan Elements	Plan Items Involved	Increased Annual Commodity Production, etc.	National Economic Development Effects (Annual) Beneficial	National Economic Development Effects (Annual) Adverse	Environmental Quality Beneficial/Adverse Effects	Regional Development Effects (Annual) Beneficial/Adverse		Social Well Being Beneficial/Adverse Effects	Agencies & Programs Involved
		Quantity/Units	- - - $1,000 - - -			- - - - $1,000 - - -			
Accelerate land treatment & vegetative management.	NED: (1,11, 12) EQ: (18,19, 21,24,26)								
Agr. production		92,000T. hay equiv.	820	460	Reduced erosion & non-point sediment pollution. Improved fishery & wildlife habitat. Some wildlife disturbance during forest thinning & timber harvest. Maintained scenic beauty.	1,640	230	6 man-yrs. employ.	SCS, ASCS, FS, State, private
Forest products production		18 MCF roundwood 5 MCF other wood	35,700	31,000					
Erosion protection:			---	2,238		2,000	558	80 man-yrs. employ.	
Ag. lands		110,500 ac. protected							
Forest lands		61,000 ac. "							
Roads & trails		2,460 mi. "							
Streambanks		51 mi. "							
"Other" lands		56,000 ac. "	680	670		680	340		
Protect natural beauty		Balloon logging, etc.		25,580		10,633	21,656	High capital investments.	
Stop unneeded subdivision of agricultural & forested lands.	NED (14) EQ: (28)	Avoid 47,000 acres of unneeded subdivision.	460	250	Preserve wildlife habitat. Increased building concentration on existing subdivisions.	920	250	Maintain economic resource base & rural environment.	State & local government, private pressure
Preserve wildlife habitat.	EQ:(20,24, 25,26,27,28)		---	7,278		---	4,060		
TOTAL $	XXX	XXX	79,027	103,037	XXX	167,500	61,838	XXX	XXX

TABLE IX-3--PREFERRED PLAN EFFECTIVENESS IN SATISFYING NEEDS

CLARK FORK OF THE COLUMBIA RIVER BASIN

PLAN ELEMENTS (Early Action 1990)	Units	PLAN EFFECTIVENESS: Identified Needs From Chapter VII	PLAN EFFECTIVENESS: Plan Provides	PLAN EFFECTIVENESS: Remaining Unmet Needs
(1) Additional basic industry employment, including those from USDA programs	Nos. full-time jobs	7,350	7,350	None
(3) Drainage of cropland with high water table	Acres	90,000	12,800	77,200
(4) Store early runoff water for late summer irrigation on acres now short of late-season water	Acre-feet	324,800	19,730	305,070
	Acres	197,500	11,560	185,940
(5) Improve municipal water supply systems	Nos. of towns	20	20	None
(6) Need added funding for recreational services on public land and added camping stalls at overused sites	$1,000/Yr.	1,135	1,135	None
	Camp stalls	184	184	None
(9) Additional access sites:				
to public lands	Nos. sites	19	19	None
to fishing streams	Nos. sites	40	40	None
(10) Boating access facilities on fluctuating reservoirs and white-water river sites	Nos. sites	6	6	None
	Nos. sites	5	5	None
(11) Land treatment acceleration to improve production and efficiency of resource use				
Irrigated land	Acres	109,130	109,130	None
Commercial forest	Acres	1,560,000	1,150,000	410,000
(12) Land treatment to preserve use of "other" land	Acres	56,000	56,000	None

TABLE IX-3--PREFERRED PLAN EFFECTIVENESS IN SATISFYING NEEDS
CLARK FORK OF THE COLUMBIA RIVER BASIN

PLAN ELEMENTS (Early Action 1990)	PLAN EFFECTIVENESS			
	Units	Identified Needs From Chapter VII	Plan Provides	Remaining Unmet Needs
(14) Preserve present use of better cropland and commercial forest	Acres	47,000	47,000	None
(15)(16) Erosion and sediment control:				
Cropland	Acres	110,500	110,500	None
Forest land	Acres	61,000	61,000	None
Other land	Acres	56,000	56,000	None
Roads and trails	Miles	2,460	2,460	None
Streambanks	Miles	51	51	None
(17) Tertiary sewage treatment	Towns	21	21	None
(18) Control irrigation return flows	Acres	109,130	109,130	None
(19) Reduced fluctuations on reservoirs	Nos. reservoirs	11	Nil	11
(20) Protect riparian vegetation	Acres	79,000	79,000	(Continuing)
(21) Additional access sites to National Forest	Nos. sites	19	19	None
(22) Protect open & green space Natural Beauty	Acres	All	All	(Continuing)

TABLE IX-3--PREFERRED PLAN EFFECTIVENESS IN SATISFYING NEEDS (Continued)
CLARK FORK OF THE COLUMBIA RIVER BASIN

PLAN ELEMENTS (Early Action 1990)	Units	PLAN EFFECTIVENESS: Identified Needs From Chapter VII	PLAN EFFECTIVENESS: Plan Provides	PLAN EFFECTIVENESS: Remaining Unmet Needs
(23) Protect free-flowing streams	Miles	2,297	1,123	1,174
(24) Provide minimum streamflows	Miles	2,484	2,484	(Continuing)
(25) Control water temperature and flow fluctuations below Hungry Horse reservoir	Rereg. Res. Multi. outlet	1 1	1 0	None (solved by rereg
(26) Preserve wildlife habitat				
Big game range	Acres	1,300,000	183,000	1,117,000
Upland game	Acres	13,600	9,700	3,900
Wetlands	Acres	122,800	105,200	17,600
(27) Fish passage around blockage structures	Nos.	All	All	(Continuing)
(28) Protect wildlife habitat from subdivision	Projected acres	All	All	(Continuing)
PREFERRED PLAN EFFECTIVENESS ON COMMODITY NEEDS	(1,000s)			
Wheat	Bu	554	54	500
Barley	Bu	590	65	525
Hay	Tons	321	69	252
Wood production	Cubic-feet	42,000	23,000	19,000

Note: Nil means immeasurable small change.

X--OPPORTUNITIES FOR IMPLEMENTING PLAN ELEMENT UNDER USDA PROGRAMS AND PROGRAMS OF OTHER AGENCIES

Chapter IX presented the preferred or recommended compromise Early Action plan to be accomplished by 1990 which includes a blend of economic development elements and environmental quality enhancement elements that were selected as being most acceptable to the majority of the public. This chapter presents the USDA programs and programs of other agencies that are available to help accomplish those plan elements and evaluates the probable impacts of their implementation. For a summary of USDA agency programs related to planning elements, see table V-16. This presentation concentrates on elements of the early action preferred plan and existing programs, with suggestions for new legislation.

EARLY ACTION ELEMENTS AS RELATED TO AGENCY PROGRAMS

National Economic Development Elements

(1) Provision of more manufacturing for export and more services to people outside the basin in order to sustain basic employment for the present population and anticipated increasing populations are largely limited to technical coordination under RC&D programs and advice on forest products technology under Forest Service programs. Economic Research Service can provide data on freight differentials and market-source situations. Creation of new manufacturing is largely limited to the private sector. USDA programs and policies are directed toward maintaining and improving production from renewable natural resources which tends to maintain employment in agricultural and forestry sectors.

Local communities need to decide for themselves on growth or no-growth goals. If communities opt for a growth goal, they can get technical and some financial assistance from programs administered by agencies of the U. S. Departments of Commerce, Labor, Housing and Urban Development, Interior, Transportation, and Agriculture. There are numerous state and local agencies to assist community growth. However, most basic manufacturing is limited to the private sector. The communities in this basin should emphasize their excellent environmental conditions when trying to attract new industry. There needs to be a reevaluation of existing freight rate structuring and a change to cost-of-service policy as compared with existing raw material freight subsidy. Existing freight rates tend to hold Montana in a raw material/extractive export economy. At the same time, manufactured goods are charged higher rates which tends to keep manufacturing out of Montana.

(3) Drainage of cropland with high water table problems can be accomplished under ASCS and SCS programs for either individual farms or group projects

under ACP programs, RC&D measure plans, and PL-566 projects. Drainage is very dependent on capital investment of the private landowner.

(4) Storage of excess spring runoff water for late-season irrigation, streamflow augmentation, and incidental flood prevention can be provided under USDA programs where feasible on drainages less than 250,000 acres in size under either the PL-566 watershed program or under the RC&D measure program or in some cases under group ACP programs. Loan funds are available under FmHA programs. Additional sources of assistance are available from Montana agencies such as MDNR&C and Fish and Game and from U. S. Army Corps of Engineers and Bureau of Reclamation.

During the basin study, 26 potential watershed projects were evaluated. Only six projects proved to be economically feasible at current construction costs and Water Resources Council's current normalized prices for agricultural commodities. One environmental enhancement watershed was also evaluated. These projects are shown on map X-1. Five of the feasible projects were irrigatirn or supplemental irrigation storage and one was for municipal water supply storage. Watershed investigation reports were written for seven projects, including a very desirable Environmental Quality enhancement watershed. As listed from the top of the basin on downstream, the feasible watersheds are:

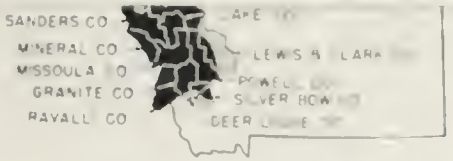
2a-2, Browns Gulch--supplemental storage and recreation
2a-11, Lower Willow Creek--supplemental storage
2a-17a, Rattlesnake Creek--municipal water*
2a4-6, Stillwater Lakes--supplemental storage
2a4-7a, Whitefish Lake--supplemental storage and recreation
2a4-11, Creston Bench--pump sprinkler irrigation
2a4-10, Ashley Creek--Environmental Quality enhancement*

*Presently not eligible for PL-566 assistance

(5) Assistance for municipal water supply systems can be provided under FmHA programs for communities under 10,000 population and from the Department of Housing and Urban Development for towns over 10,000.

(6) Assistance can be provided under accelerated funding and programs of the Forest Service.

(9) Technical and financial assistance for the acquisition and development of fishing access sites can be provided in RC&D areas under measure programs and in PL-566 projects under recreational facilities measures. Public land access sites can be acquired and developed for national forest lands under Forest Service programs. Montana Department of Fish and Game has an active program for acquisition of fishing access sites. The Department of State Lands has the ability to acquire public access to state land; however, most state lands are operated as lease holdings to individuals. The Bureau of Outdoor Recreation provides some funds for acquisition and development of access sites. The Bureau of Reclamation and the Corps of Engineers can incorporate public access to water recreation in their projects.



LOCATION MAP

MAP X 1

WATERSHED INVESTIGATION ANALYSES

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

under ACP programs, RC&D measure plans, and PL-566 projects. Drainage is very dependent on capital investment of the private landowner.

(4) Storage of excess spring runoff water for late-season irrigation, streamflow augmentation, and incidental flood prevention can be provided under USDA programs where feasible on drainages less than 250,000 acres in size under either the PL-566 watershed program or under the RC&D measure program or in some cases under group ACP programs. Loan funds are available under FmHA programs. Additional sources of assistance are available from Montana agencies such as MDNR&C and Fish and Game and from U. S. Army Corps of Engineers and Bureau of Reclamation.

During the basin study, 26 potential watershed projects were evaluated. Only six projects proved to be economically feasible at current construction costs and Water Resources Council's current normalized prices for agricultural commodities. One environmental enhancement watershed was also evaluated. These projects are shown on map X-1. Five of the feasible projects were irrigatirn or supplemental irrigation storage and one was for municipal water supply storage. Watershed investigation reports were written for seven projects, including a very desirable Environmental Quality enhancement watershed. As listed from the top of the basin on downstream, the feasible watersheds are:

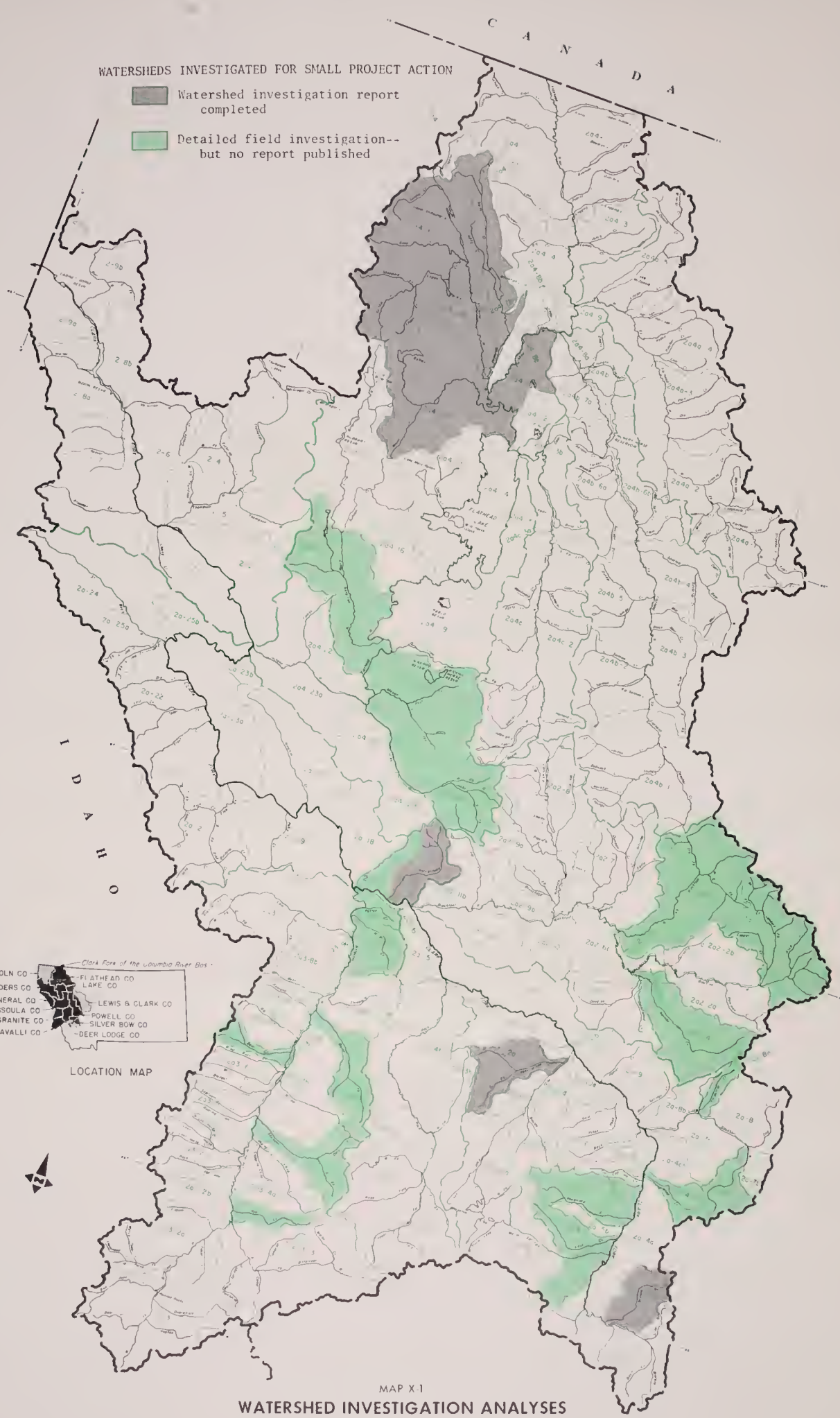
2a-2, Browns Gulch--supplemental storage and recreation
2a-11, Lower Willow Creek--supplemental storage
2a-17a, Rattlesnake Creek--municipal water*
2a4-6, Stillwater Lakes--supplemental storage
2a4-7a, Whitefish Lake--supplemental storage and recreation
2a4-11, Creston Bench--pump sprinkler irrigation
2a4-10, Ashley Creek--Environmental Quality enhancement*

*Presently not eligible for PL-566 assistance

(5) Assistance for municipal water supply systems can be provided under FmHA programs for communities under 10,000 population and from the Department of Housing and Urban Development for towns over 10,000.

(6) Assistance can be provided under accelerated funding and programs of the Forest Service.

(9) Technical and financial assistance for the acquisition and development of fishing access sites can be provided in RC&D areas under measure programs and in PL-566 projects under recreational facilities measures. Public land access sites can be acquired and developed for national forest lands under Forest Service programs. Montana Department of Fish and Game has an active program for acquisition of fishing access sites. The Department of State Lands has the ability to acquire public access to state land; however, most state lands are operated as lease holdings to individuals. The Bureau of Outdoor Recreation provides some funds for acquisition and development of access sites. The Bureau of Reclamation and the Corps of Engineers can incorporate public access to water recreation in their projects.



MAP X-1

WATERSHED INVESTIGATION ANALYSES

CLARK FORK OF THE COLUMBIA RIVER BASIN

MONTANA

MARCH 1977

10 0 10 20 MILES

SCALE 1 : XXX,XXX

Base map prepared by SCS, Portland Cartog. Unit from AMS 1:250,000 series.
Thematic detail prepared by State Staff.
U.S. DEPARTMENT OF AGRICULTURE

M7-N-23425-21

(10) Boat ramps and docks can be developed on reservoirs on nonfederal lands in RC&D areas as recreational measures or under recreational facilities if the reservoir is in a PL-566 watershed. Similar facilities can be developed on reservoirs in the National Forest under Forest Service recreational programs. Private individuals and civic organizations can do a lot of this type of development without agency assistance. The Bureau of Reclamation and the Corps of Engineers can provide similar facilities on their reservoirs. Montana Department of Fish and Game and MDNR&C can develop boating facilities on state reservoirs.

(11) Land treatment assistance on private lands can be accelerated under ongoing PL-46 programs on crop and rangeland, under RC&D programs for associated measures, and under cooperative federal/ state/private forestry programs on forested lands, depending on availability of funds. Land treatment on State lands and rights-of-way are the responsibility of the particular State agency administering those lands. The greatest investment in and responsibility for land treatment still depend on the individual landowners.

(12) Land treatment on private "other" lands can be accelerated under PL-46 programs. The greatest state activity in land treatment on other lands deals with treatment of highway rights-of-way and state construction sites and depends on the particular agencies involved. Private landowners of "other" lands are particularly involved in subdivisions and rural residential construction sites. In many of these latter areas, there is a need for strong legislation to require the landowner to prevent erosion during and after construction.

(14) Moratorium on subdivision of better agricultural and commercial forest lands is dependent on state and local laws and their enforcement. However, SCS and FS can identify productive capability of lands before they are subdivided.

Environmental Quality Elements

(15)(16) Land treatment to reduce erosion and sediment production can be accelerated under PL-46 for nonfederal lands and under Forest Service programs for National Forest lands. Section 216 funds are often used in rehabilitating critical areas of streambank erosion. More pressure is being brought to bear by 208 studies to prevent nonpoint pollution from sediment. Much of the burden of land treatment to prevent erosion and sediment production rests with private landowners, county road departments, cities, and Montana Department of Highways.

(17) Technical and financial assistance for sewage treatment facilities can be provided under FmHA programs for communities under 10,000 population and under HUD programs for towns over 10,000 population. Assistance is available under PL-46 for agricultural pollution abatement. An increased availability of these funds may result from the 208 studies now under way in the basin.

In any event, implementation will require considerable investment by local communities.

(18) Assistance for conversion to sprinkler irrigation can be accelerated under PL-46 programs, but there may be a need to increase cost sharing incentives in some areas. Some coal tax funds may become available to help this conversion and some Old West Regional Commission funds might be used. It is estimated that the greatest investment will still be made by the private landowners.

(19) Operation of reservoirs depends on economics of private sectors and non-USDA agencies. Three reservoirs are operated by MDNR&C, one by Bureau of Reclamation, five by private power companies, and the rest by private irrigation companies.

(20) Protection of riparian vegetation on private lands depends on local and state laws. The SCS and FS can advise private owners on the logic of protecting vegetation on those lands and the FS can protect riparian lands on the National Forest under ongoing programs.

(21) Additional access points to National Forest and public domain lands to disperse recreational use can be acquired and developed under existing FS and BLM programs, depending on the levels of funding and popular moral support.

(22) A certain amount of natural beauty of open and green space can be preserved on National Forest lands and design requirements for utility lines and roads can be enforced on those lands by FS programs. Similar control on private lands would require state and local laws.

(23) Preservation of fishery class 1, 2, and 3 streams in a free-flowing state might be accomplished on National Forest lands under the Wild and Scenic Rivers programs or multiple use programs. On nonfederal lands, state laws would be needed.

(24) Reservation of minimum stream flows is within the jurisdiction of state laws subject to existing water rights.

(25) A reregulating reservoir for Hungry Horse reservoir is outside the realm of USDA programs, but is under evaluation by the Corps of Engineers and the Bureau of Reclamation.

(26) Management and acquisition of private land for wildlife habitat are outside of USDA programs. However, National Forest lands are often managed for special wildlife habitat under FS programs.

(27) Improvement of fish passage around Big Fork dam is outside of USDA programs. Future installation of instream structures such as culverts, irrigation diversions, and bridges can be developed to ensure upstream migration of fish where it is desirable. This can be accomplished on National Forest streams by

the Forest Service, at highway crossings by the Montana Department of Highways, at county road crossings by county road departments, at private crossings by informed individuals, and at irrigation diversions by group projects with technical assistance from SCS and FS. These improvements will require considerable investment and will depend heavily on moral support and pressure from concerned individuals and groups.

(28) Stopping the subdivision of wildlife habitat depends on state and local laws and their enforcement. Technical assistance in identifying critical wildlife habitat is available from the SCS, FS, Fish and Wildlife Service, and Montana Department of Fish and Game.

COMBINED EFFECTS OF USDA PROGRAMS PORTION OF THE PLAN

Six of the 10 NED plan elements remaining in the preferred plan can be largely accomplished under accelerated USDA programs and the other four elements can be assisted with technical advice under USDA programs. Nine of the 14 EQ plan elements remaining in the preferred plan can be met in part or in whole by USDA agencies which also can provide technical advice on the other five elements. Table IX-1 displays the effects of plan elements to be accomplished under USDA and other programs. A summary of effects by the four accounts, that would result from implementation of USDA portions of the plan are as follows.

National Economic Development:

	($1,000)
Annual Beneficial Effects	58,125
Annual Adverse Effects	57,115
Net Beneficial Effects	1,010

Environmental Quality:

1. Environmental Impacts

Three new reservoirs (Browns Gulch, Lower Willow Creek, and Rattlesnake) and lake storage on the Stillwater project would increase flatwater scenery by 1,235 acres while inundating about 300 acres of willow bottom habitat, 500 acres of hayland, 285 acres of hillside pasture and range, 150 acres of forest out of 150,000 acres of bottomland habitat, and five miles out of 1,074 miles of class 4 streams now having moderate use by riparian furbearers, upland game, and limited populations of waterfowl. There will be a conversion of stream fishery to cold water reservoir fishery.

Five projects, including two lake-level control structures, would store a total of 28,000 acre-feet of surplus spring runoff for late-summer irrigation, municipal water, and streamflow augmentation on 74 miles of streams.

One specialized environmental enhancement project would turn a biologically dead stream back into a trout and salmon spawning stream by cleaning up pollution from sewage and lumber mill waste. Riparian wildlife habitat will improve along this stream. Water quality would be vastly enhanced on 18 miles of this stream. Two other projects will improve temperature and water quality in 56 miles of stream.

One project will attract a significant number of recreational visitors and traffic into a watershed area.

One project will inundate 80 acres out of 16,000 acres of deer winter range in that watershed. This project will improve summer flows in five miles of stream.

Three projects will provide economic incentives for maintaining land for future agricultural use.

In one project there will be an increase of aquatic insect production on about 100 acres with the creation of shallow flooded areas.

One project will provide the opportunity to maintain and improve class 4 wetland habitat.

The protection and preservation of wildlife habitat will result in better management on about 105,200 acres of wetland habitat for waterfowl. Some 9,700 acres of marginal cropland would be converted to upland game habitat, and 183,000 acres of critical game range would be managed for big game winter habitat. Under the wild, scenic, and recreational rivers program, about 79,000 acres of riparian land would be protected in its present use. Further protection of riparian habitat would result from stopping subdivision of wildlife habitat.

Land and water management under SCS, ASCS, and FS would greatly reduce erosion and sediment pollution from 227,500 acres of crop and forest land, 2,460 miles of roads and trails, and 51 miles of streambamks. Irrigation return flows would be practically eliminated from 109,130 acres by conversion to sprinkler irrigation and improved irrigation management.

Increased irrigation uses would increase depletions by 0.25 percent on Flathead River, 1.0 percent on Whitefish River, and 2.5 percent on the Stillwater River.

2. Adverse Impacts Which Cannot Be Avoided

   a. There will be about 80 acres out of 16,000 acres of winter deer habitat inundated in one watershed.

   b. About five miles of class 4 stream will be inundated out of 1,074 miles of class 4 stream in the basin.

c. Four projects will inundate 300 acres of willow bottom habitat, 500 acres of hayland, 285 acres of hillside pasture and range, and 150 acres of forest land.

d. Recreational visitor traffic would be increased in one watershed.

3. Alternatives

One alternative to the elements of the preferred plan would be a "future without action." Trends would continue in the basin, including less orderly subdivision growth, encroachment on riparian and forest fringe habitat, and continued degradation of water quality.

The NED alternative to the preferred plan emphasizes elements for economic development. The effects of this alternative are displayed in table VIII-1. As compared with the preferred plan, this alternative would result in a larger number of wetland acres drained for cropland use and does not include low flow augmentation.

The EQ alternative to the preferred plan emphasizes elements for environmental quality preservation and enhancement. The results are displayed on table VIII-2. As compared with the preferred plan, this alternative would result in more acres of management of upland big game habitat and more protection of free-flowing rivers.

For further comparison of these latter alternative plans and the preferred plan, see table IX-1.

4. Relationship between local short-term uses of man's environment and the maintenance of long-term productivity

The preferred plan will contribute to the continued use of agricultural lands and the maintenance and improvement of the productive capacity of lands in the basin. Land treatment measures will permit continued use of the land to serve the present generation while preserving it for use by future generations. Farmers will have a wider selection of crops and cropping patterns from which to choose.

Measures for the protection and enhancement of fish and wildlife will have a sustaining positive impact in both short-term and long-term use of the environmental resources.

Dispersed access to national forest lands will help protect the quality of the forest area for use by succeeding generations.

5. Irreversible and irretrievable commitment of resources

Water impoundments would result in a commitment of 1,235 out of 150,000 acres of bottomland habitat and include five miles of free-flowing

class 4 streams out of 1,074 miles of class 4 streams in the basin. A related commitment would be required for labor and construction resources. During the project life there would be an increase of water depletions for irrigation by 1.0 percent on the Whitefish River, 2.5 percent on the Stillwater River, and 0.25 percent on Flathead River.

Regional Development:

Agricultural programs develop benefits from increased or sustained output of goods and services which are largely sold outside the basin and are thus considered basic income production. The Montana basic to total income multiplier varies from just below 2.0 to about 2.15 for most agricultural and forestry products. For simplex comparison, annual NED beneficial effects of $58,125,000 generate secondary beneficial effects in derivative and service industry of about $58,125,000 for a total annual effect of $116,250,000 if all USDA preferred plan elements were implemented. This implementation would generate about 1,918 basic employment jobs and a similar amount of derivative employment jobs.

Dryland to irrigation would increase by 6,260 acres. Supplemental irrigation water would increase 19,730 acre-feet. Wet cropland would be drained to improve production on 12,800 acres. Forest production would improve on 1,150,000 acres.

Social Well Being:

Water quality would be improved on 86 miles of streams. Recreation quality would be enhanced by better dispersion at new access sites and improved stream flows. Through accelerated land treatment and forestry management, the concepts of longer range sustained production can be achieved rather than have the basin continue to decline in agricultural and forestry production.

NEED FOR ADDITIONAL FEASIBILITY STUDIES

In light of the identification of additional physically irrigable land by the MDNR&C and Montana policy for increased irrigation development, it is recommended that a USDA-State Cooperative Special Study be conducted to determine the feasibility of additional irrigation development. Some of the area identified by MDNR&C was included in the watershed investigations of this study while smaller private development potential and developments larger than allowed by PL-566 were not evaluated. Areas, by major drainages, that were included in MDNR&C identification for intensive studies to determine the feasibility of development include:

Flathead

(a) Enlarging storage and line canals on the Flathead Irrigation Project.

(b) Increasing assistance and funding of conversion to sprinkler irrigation and private group pump units.

(c) Developing additional areas on Creston Bench for irrigation.

(d) Storing supplemental water in Upper Stillwater Lake for use by private irrigation development.

(e) Developing group pump units for sprinkler irrigation of the Flathead delta between the head of the lake and Kalispell.

(f) Providing additional technical and financial assistance on the Flathead Irrigation Project for electrical facilities to accelerate completion of conversion to sprinkler irrigation.

Bitterroot

(a) Increasing storage on Lake Como and divert Lost Horse Creek water through Como for combined irrigation and power generation.

(b) Completing all practical lining of the Bitterroot Irrigation District (BRID) canals.

(c) Installing all economically feasible gravity sprinkler systems.

(d) Rehabilitating the Ravalli Water Users Association diversions, canals, and control structures.

(e) Wherever practical, combining small parallel ditches and associated ditch companies for greater efficiency of delivery and administration.

(f) Developing additional water storage sites where feasible.

(g) Encouraging contracts for water purchase from Painted Rocks Reservoir on the West Fork of the Bitterroot River to assure a full supply of late-summer water for all acres using direct diversion from the river downstream from the reservoir.

Blackfoot

(a) Storing additional water wherever economically feasible for use on existing irrigated acres and on new acres that are feasible to develop.

(b) Accelerating assistance to develop private pump-sprinkler projects.

(c) Improving Nevada Creek Water Users system.

Flint Creek

Developing additional storage for use on the Lower Willow and Flint Creek Water Users Association projects and on new acreages that are feasible to irrigate.

Deer Lodge and Little Blackfoot Valleys

Developing storage where feasible to provide late-season water on presently irrigated acres and for new irrigation.